B·A
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Roof Condition Report

9BSE-G - General Services

Intermountain Power Service Corporation
850 West Brush Wellman Road
Delta, Utah

June 2001

Brower & Associates
Architects & Planners

1776 North State Street, - Suite 300
Orem, Utah 84057-2025

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Table of Contents

INTRODUCTION

During the months of May and June, 2001, most of roofs of the Intermountain Power Project were evaluated by Brower & Associates, Architects and Roof Consultants, with regards to the condition of their roofs. Each roof was drawn, examined, photographed and analyzed.

The data taken from each roof was entered into MicroRoofer, a program produced and maintained by the University of Illinois at Urbana for the U.S. Army Corps of Engineers. The roof history of thousands of buildings, both military and civilian, are in the data base of the program. Each year, current data is added to the data base to keep the results of the evaluations up to date.

This report is the result of the inspection and the data gathered. Enough information is now available to make sound decisions about the repair and/or replacement of each roof.

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PHOTOGRAPHS

The first section of the report is a photographic record of the current conditions of the roof. Since the roofs are very similar, no attempt was made to provide an exhaustive photo history of each building.

The enclosed photographs are provided to give the reader a look at the general layouts of the roof, showing equipment, sizes and visual descriptions of defects. The full data on defects can be found in a following section.

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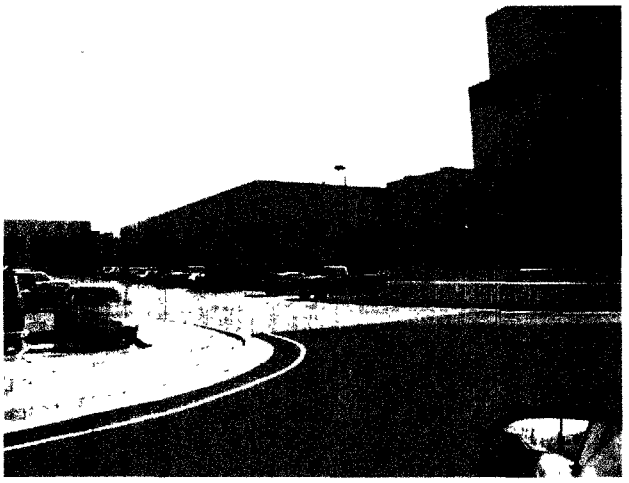

Photo No. 1-G

The northeast corner of the General Services Building, looking southwest. Unit One Boiler is to the right and the Administration Building is to the left.

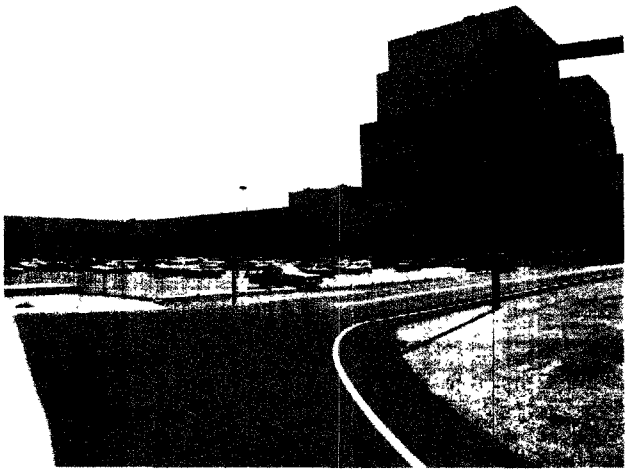

Photo No. 2-G

The General Services Building is to the left and Unit One Boiler is to the right.

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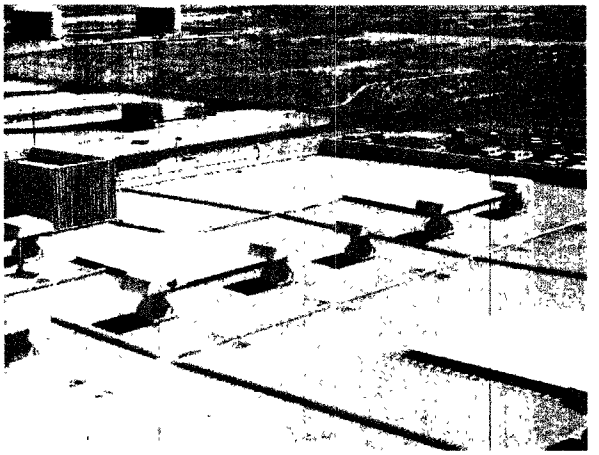

Photo No. 1

The roof of the General Services Building, as seen from the northeast corner of a lower roof section of Unit One Boiler, looking southeast. Note the foam on the expansion joint in the lower left corner.

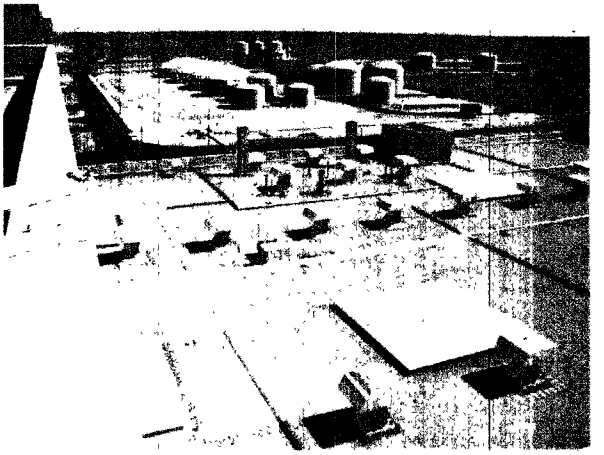

Photo No. 2

The roof of the General Services Building, as seen from the southwest corner of a lower roof of Unit One Turbine, looking north. Note the foam on the expansion joints on the left side of the photo.

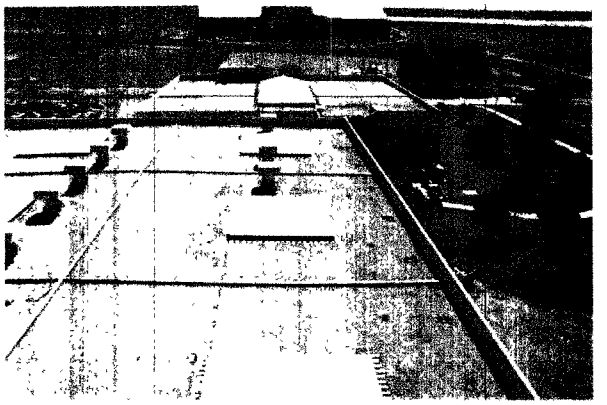

Photo No. 3

The roof of the General Services Building, as seen from the east end of the Unit One Turbine roof, looking east. The Administration Building is beyond.

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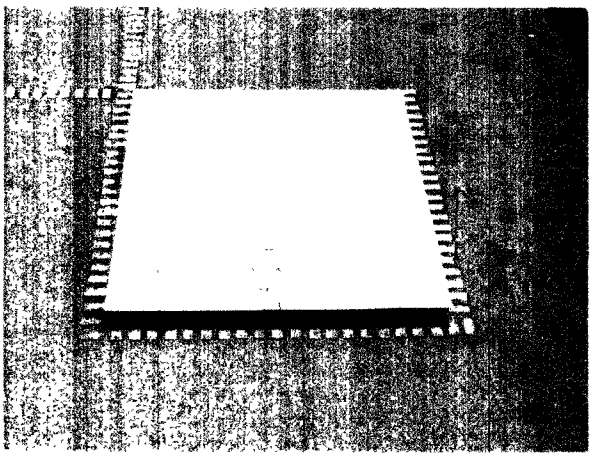

Photo No. 4

A typical skylight, as seen from the Unit One Turbine roof. All of the skylights appear to be in good condition.

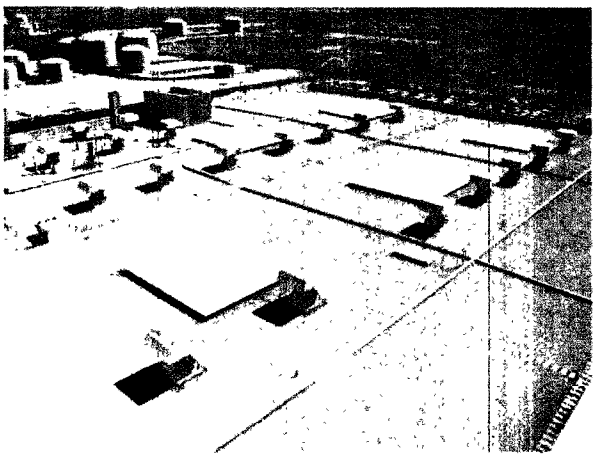

Photo No. 5

The roof of the General Services Building, looking northeast from the Unit One Turbine roof.

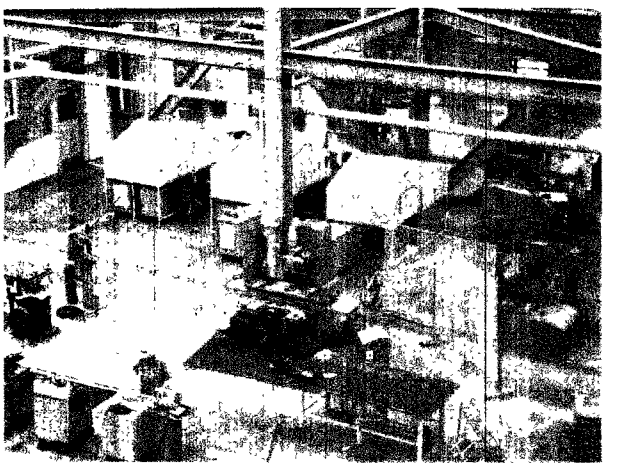

Photo No. 6

Interior roofs over tool cabinets along the south wall of the General Services Building. Now I wonder why . . .

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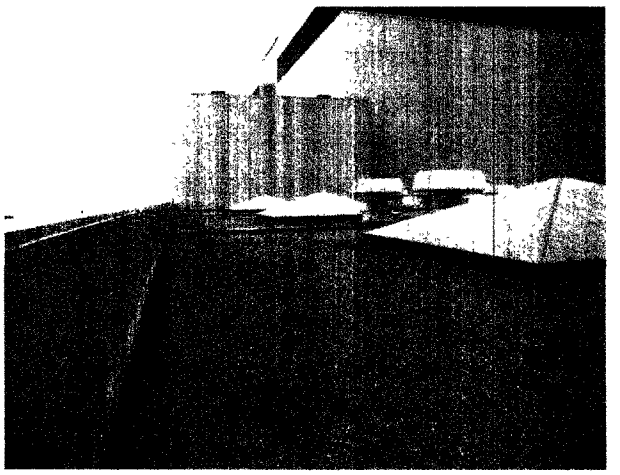

Photo No. 7

South wall of building, looking west. All but one roof drain along this wall is blocked.

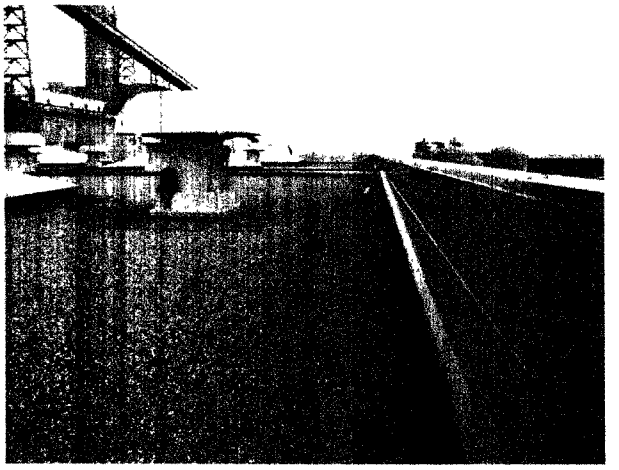

Photo No. 8

East wall of building, looking north.

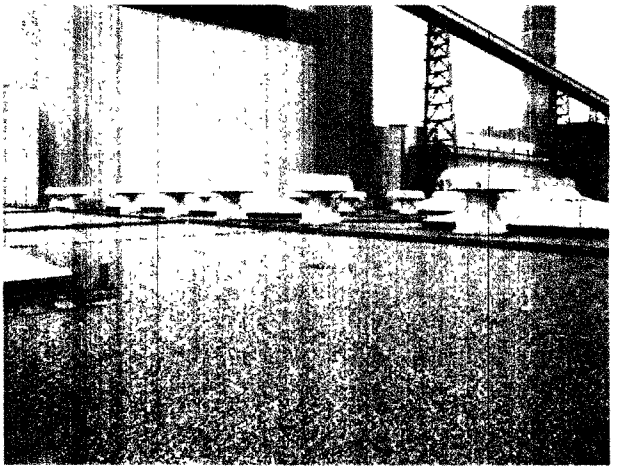

Photo No. 8

Center of roof, looking northwest.

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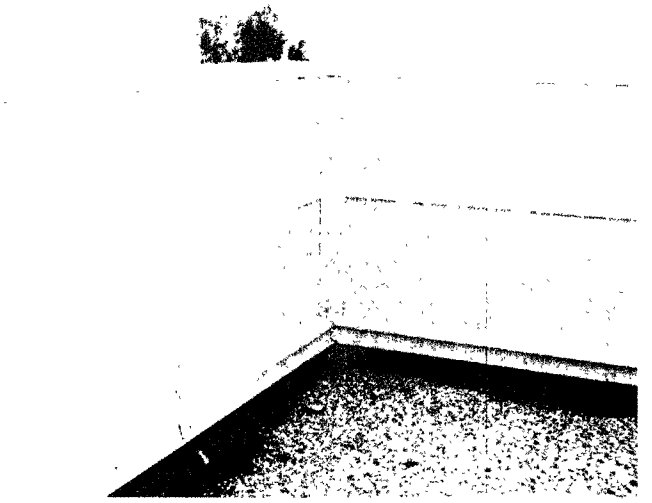

Photo No. 10

Southeast corner of the building. Gravel has been piled into the corner.

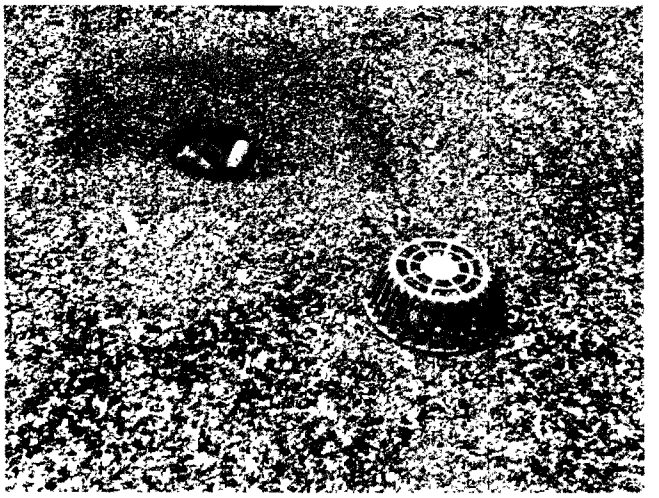

Photo No. 11

Roof drain is clogged. Strainer is not set on top of drain. The aluminum cans appear to be burned.

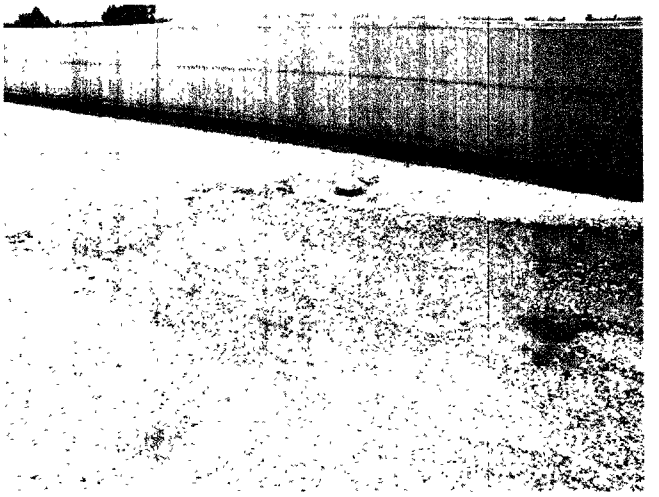

Photo No. 12

Bare area along south wall of building. Roof drain is clogged. Evidence of extensive ponding is visible.

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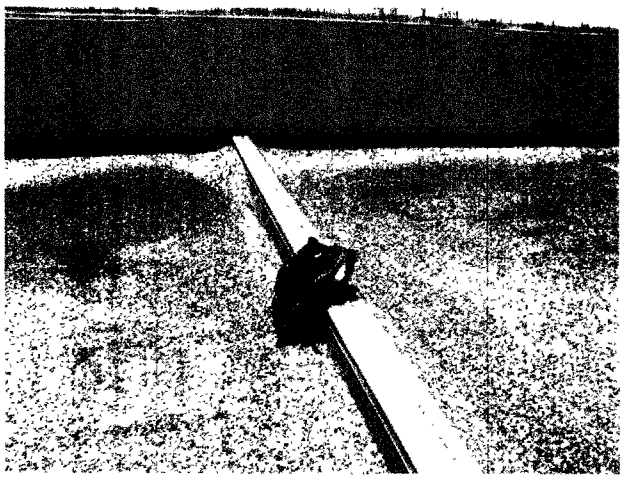

Photo No. 13

Expansion joint at south wall, looking south. The dark areas are evidence of heavy ponding.

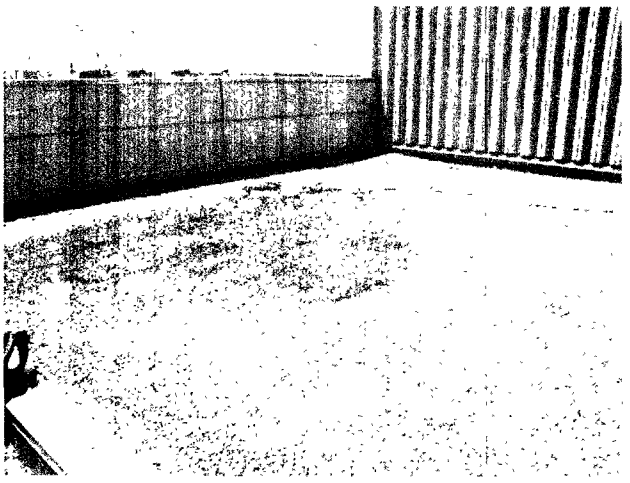

Photo No. 14

Bare area at south wall, next to Unit One. Note the dark areas showing ponding.

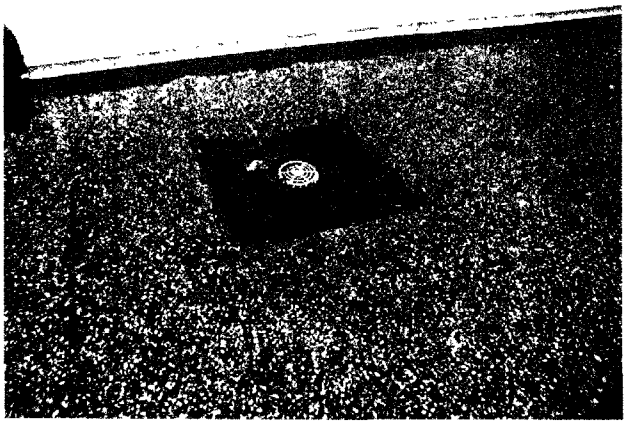

Photo No. 15

Roof drain at northwest corner of roof, filled with coal dust. The coal dust in the gravel might impede the water trying to get to the drain.

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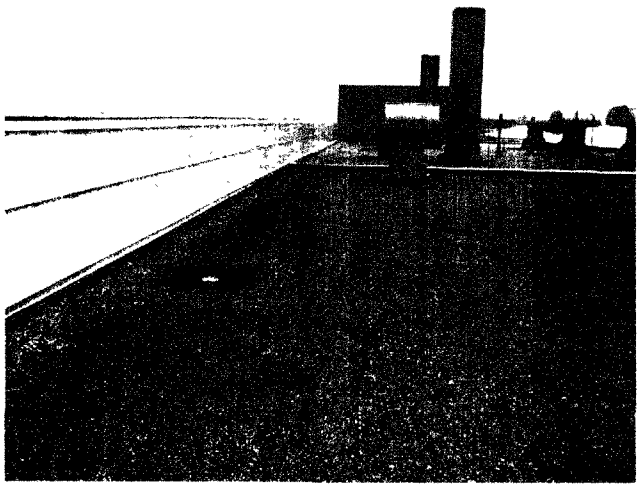

Photo No. 16

North wall of building, looking east. Roof drain is filled with coal dust.

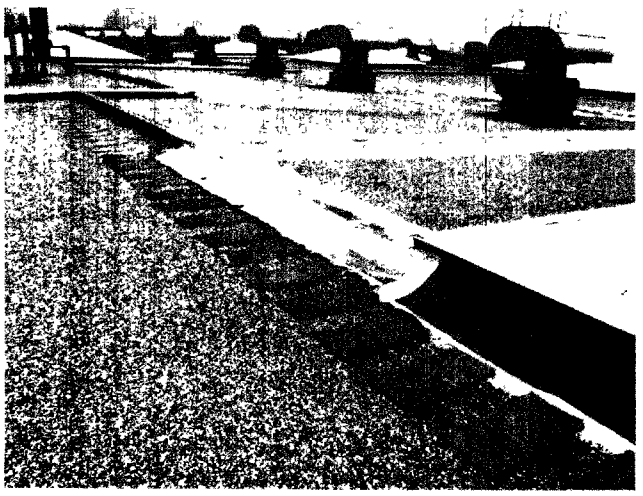

Photo No. 17

Center of roof, looking east. Note the expansion joints covered with foam. Using foam to repair a roof is a reasonable idea, as long as the gravel is removed and the roof power washed with a mild detergent. Maybe the roof drains would be cleared out, too.

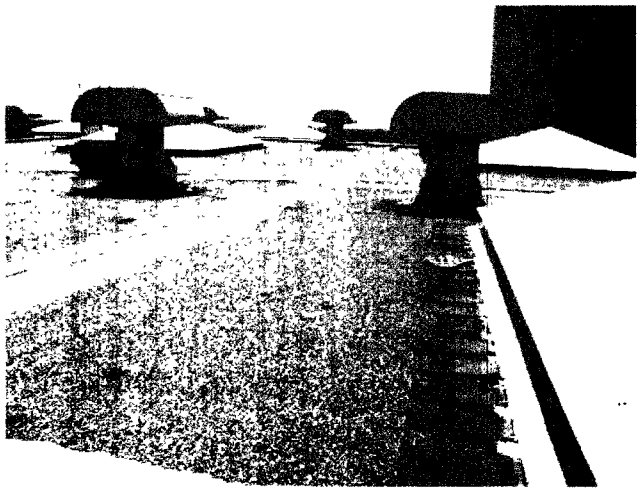

Photo No. 18

Center of roof, looking south. Unit One is to the right. Note the foam on the expansion joints and around the skylight.

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Photo No. 19

Center of roof, looking southeast. Note the foam on the expansion joint. The dark around the edge of the foam is evidence that the foam did not adhere to the gravel.

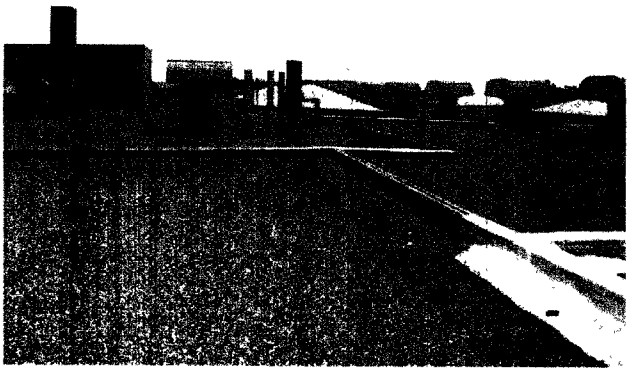

Photo No. 20

North area of the roof, looking east. North wall of building is to the left of photo.

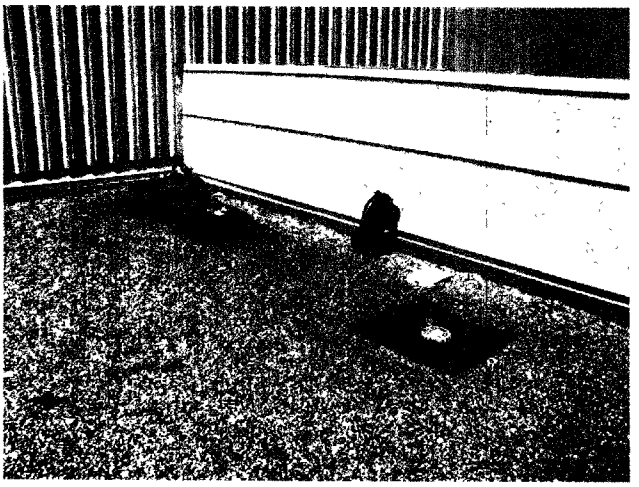

Photo No. 21

Northwest corner of the roof. Note the coal dust piled in the corner and filling the roof drains.

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Photo No. 22
Pitch pans are almost empty.

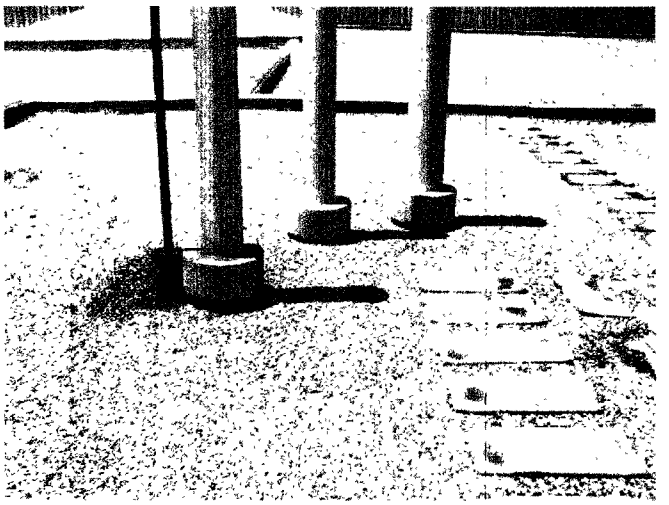

Photo No. 23

Roof stacks near north wall of roof, looking west toward Unit One. The enlarged bases of the stacks make examination of the joint very difficult.

Photo No. 24

Roof equipment near the north wall of the building - see left of photo for parapet wall. Looking east.

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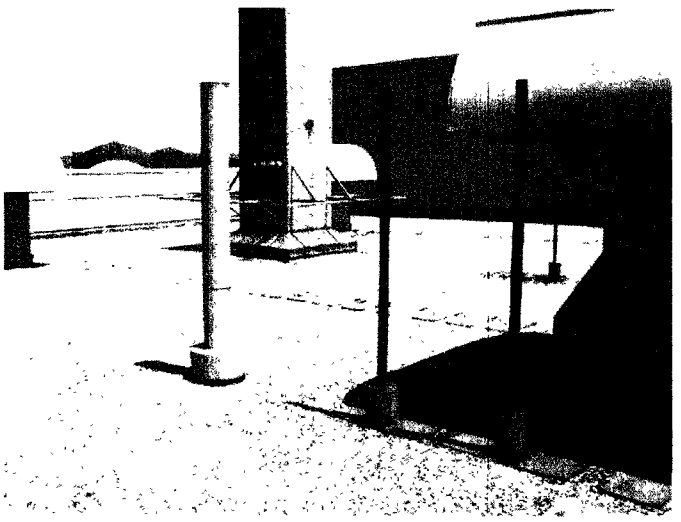

Photo No. 25

Roof equipment near north wall of building, looking northeast.

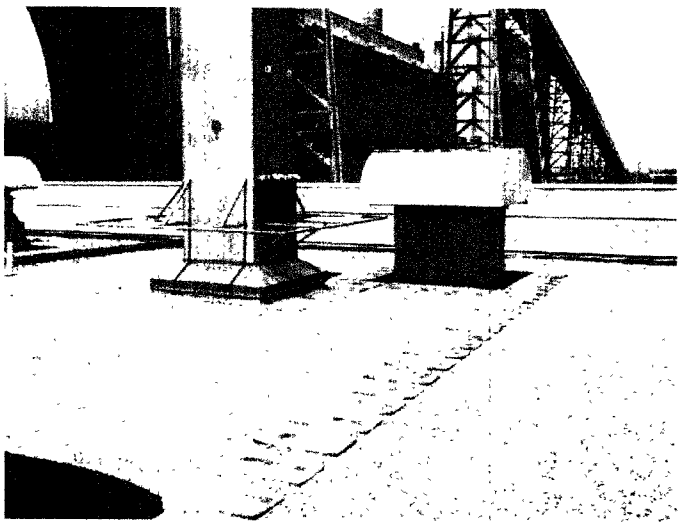

Photo No. 26

Roof vents and stacks near the north wall of the building, looking north. Note the paint peeling off the ventilator hood.

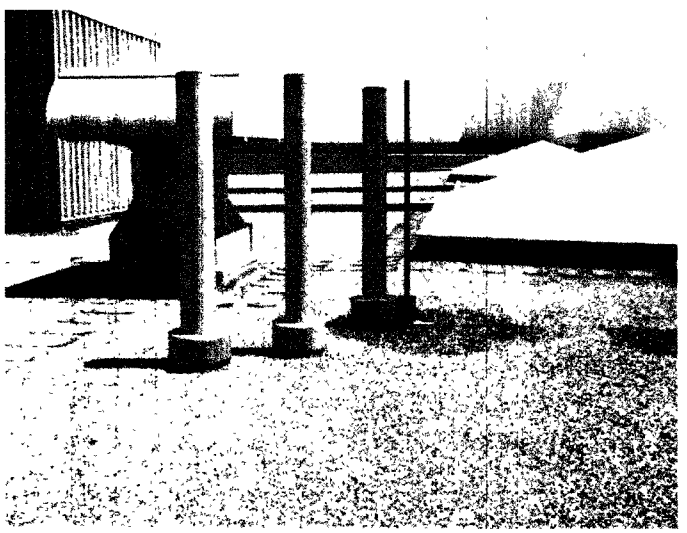

Photo No. 27

Roof stacks and skylights near north wall, looking east.

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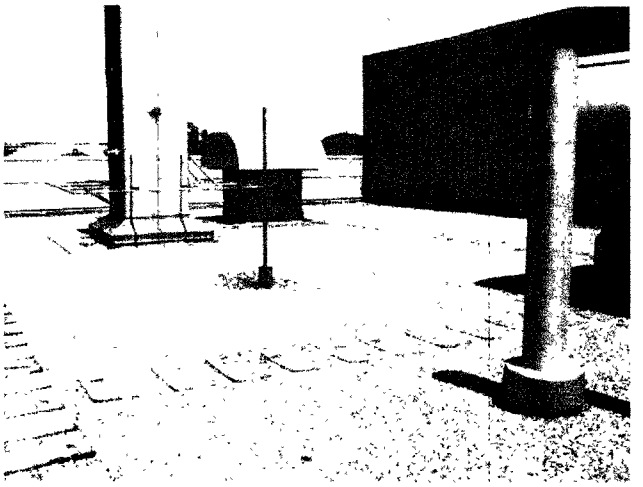

Photo No. 28

Roof stacks near north wall of building, looking north.

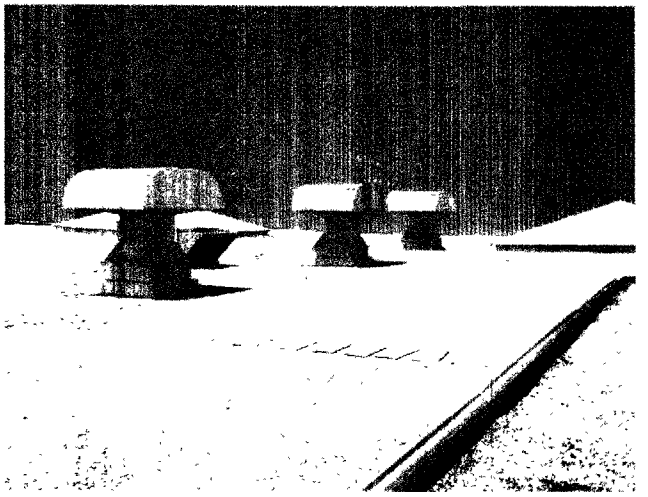

Photo No. 29

Roof vents in center of roof, looking west at Unit One.

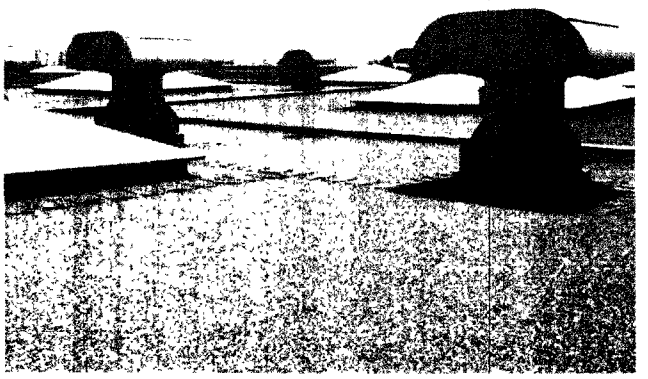

Photo No. 30

Roof vents and skylights in center of roof, looking southeast.

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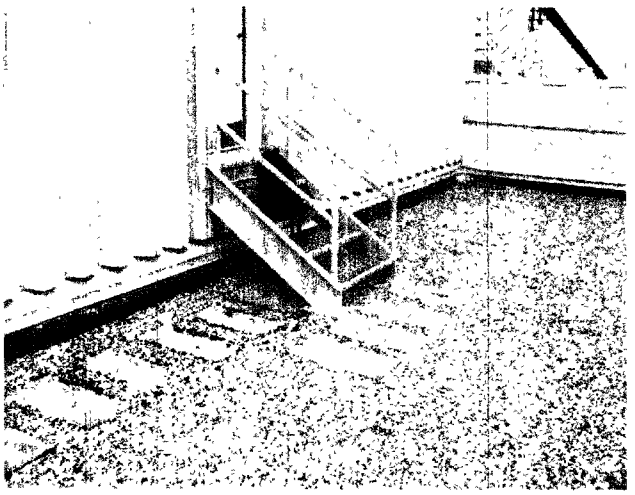

Photo No. 31

Stairs at elevator (?) roof, east side, looking at the north wall of the building, looking north.

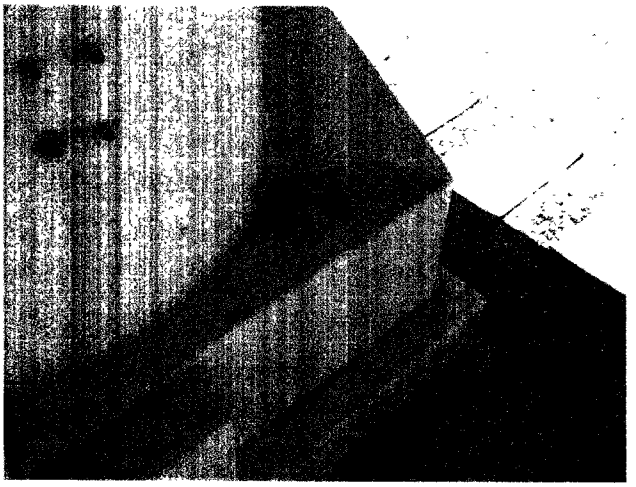

Photo No. 32

Rust on vent equipment. Rust is present in nearly half of the equipment.

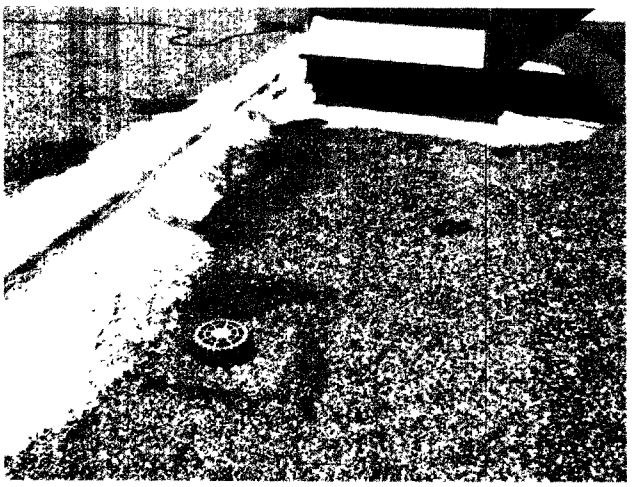

Photo No. 33

Expansion joint in center of roof, looking west. Note the foam over the joint and around the equipment. Three attempted patches are shown in the photo. The orange foam has lost the acrylic coating and is severely damaged by the UV rays of the sun. The drain pan is almost filled with gravel.

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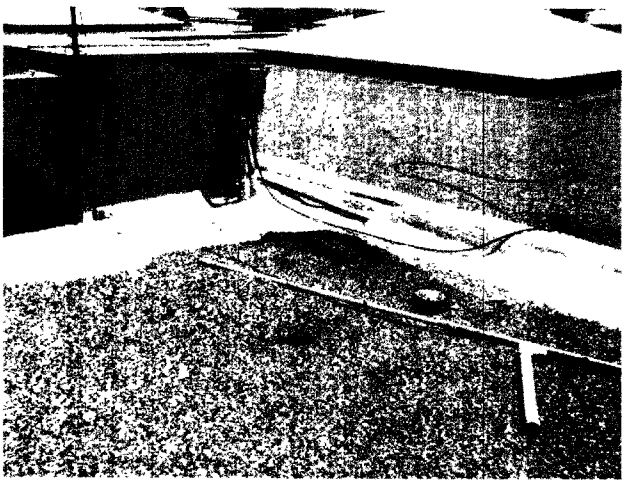

Photo No. 34

Opposite end of equipment shown in Photo No. 71 above. Damage to the foam is shown in the center of the equipment. Note the TV antennae on the ground.

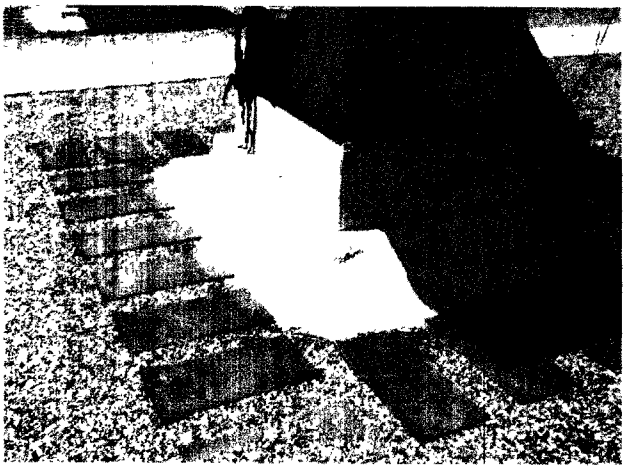

Photo No. 35

Foam around vent equipment.

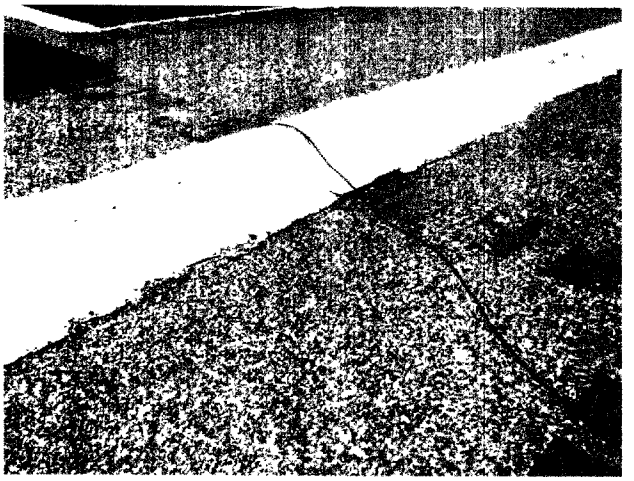

Photo No. 36

Foam over the expansion joint. Note the gap between the foam and the gravel, most visible where the wire crosses. The foam did not adhere to the roof membrane because the gravel was not first removed.

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Photo No. 37

Foam over expansion joint. Attempted repairs are shown on both sides of the expansion joint. Equipment is shown in Photos 71 & 72. The orange showing in the foam is exposed foam not covered by surfacing. UV rays from the sun damage the foam very quickly if it is not protected by the acrylic coating.

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Section Inventory Report

The Section Inventory Report is provided so the Owner can see the information on the entire project without going through each individual report. The same information is included in the reports for the individual buildings.

The report lists the construction characteristics of each building.

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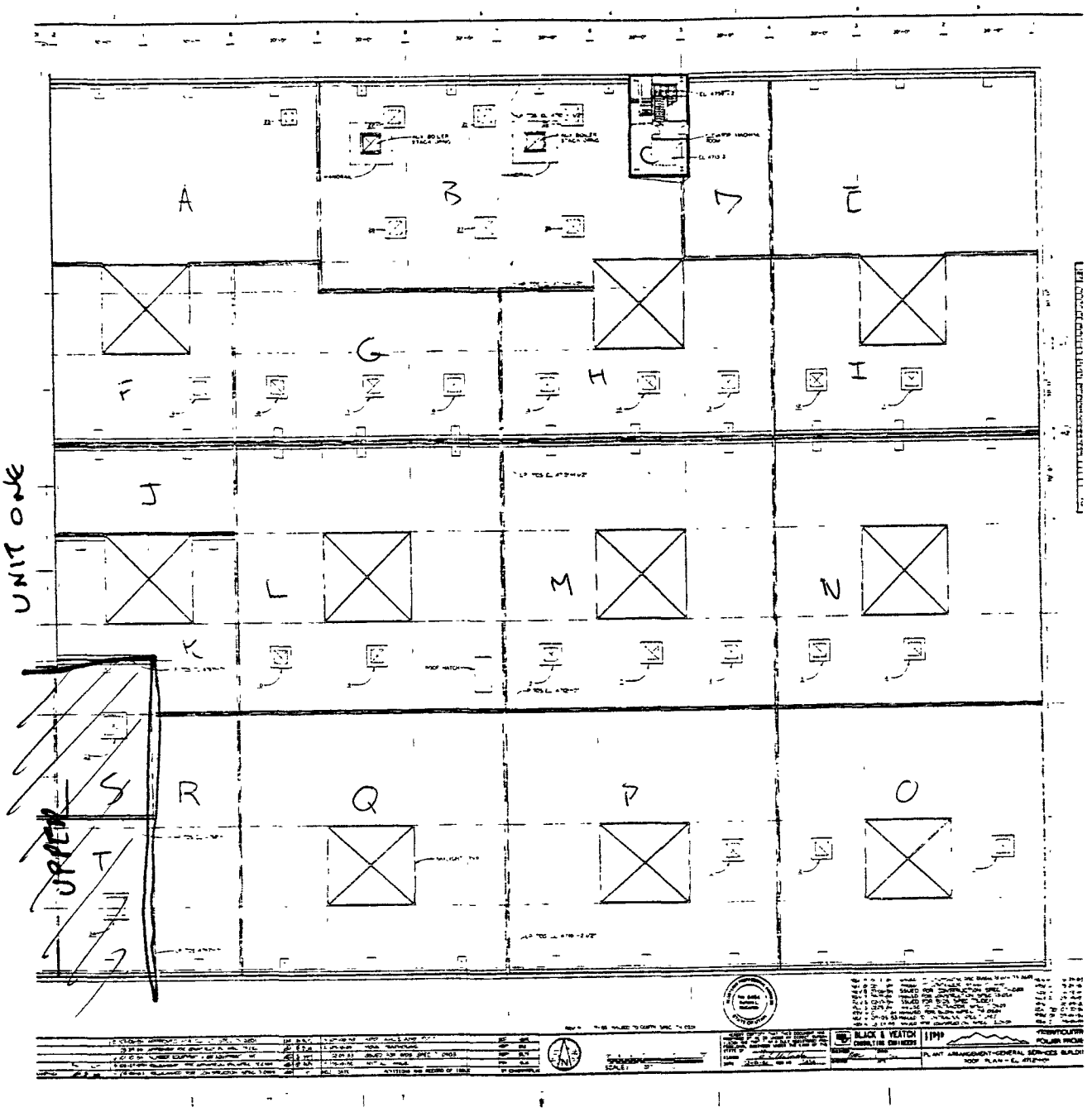

General Services Bldg. (#2)

ANNETTE -

Installation: IPP - Intermountain Power Project

Building No.: 9BSE-G Section: 9BSEGA Area: 5540 Sq.Ft.

Last Replacement: Original Construction: 1985
Occupancy: Maintenance

Perimeter
Parapet: 153 Ft. Exp. Joint: 133 Ft. Adj. Wall: 20 Ft.
Roof Edge: Ft. Area Div.: Ft. Other: Ft.
Access: PENTHOUSE Adj Roof Sec:

Structural Frame: STEEL: Bar Joists/Beams & Columns

Roof Deck: STEEL
Slope: 1/4
Drainage: INTERIOR DRAINS

Vapor Retarder: UNKNOWN

Insulation: EXPANDED POLYSTYRENE
Thickness: 4 In. Layers: 2 Tapered: N
R-Value: 19
Attachment: LOOSE LAID

Membrane: Mfg: Spec. No.:
Description:
Protected Mem.: N
Type: BUR: Asphalt
Attachment: FULLY ADHERED
Reinforcement: B.U.(HOT/COLD): Glass Felt
Surfacing: AGG: Pea Gravel
Walkways: ASPHALT PLANK

Base Flashing: REINFORCED ASBESTOS
Flashing Adhesive: HOT MOPPED
Counterflashing: METAL
Types: WALL/PARAPET

Remarks:

Installation: IPP - Intermountain Power Project

Building No.: 9BSE-G Section: 9BSEGB Area: 8160 Sq.Ft.

Last Replacement: Original Construction: 1985
Occupancy: Maintenance

Perimeter
Parapet: 100 Ft. Exp. Joint: 168 Ft. Adj. Wall: 120 Ft.
Roof Edge: Ft. Area Div.: Ft. Other: Ft.
Access: EXTERNAL LADDER: Temporary Adj Roof Sec:

Structural Frame: STEEL: Bar Joists/Beams & Columns

Roof Deck: STEEL
Slope: 1/4
Drainage: INTERIOR DRAINS

Vapor Retarder: UNKNOWN

Insulation: EXPANDED POLYSTYRENE
Thickness: 4 In. Layers: 2 Tapered: N
R-Value: 19
Attachment: ADHESIVE - HOT

Membrane: Mfg: Spec. No.:
Description:
Protected Mem.: N
Type: BUR: Asphalt
Attachment: FULLY ADHERED
Reinforcement: B.U.(HOT/COLD): Glass Felt
Surfacing: AGG: Pea Gravel
Walkways: ASPHALT PLANK

Base Flashing: REINFORCED ASBESTOS
Flashing Adhesive: HOT MOPPED
Counterflashing: METAL
Types: WALL/PARAPET

Remarks:

Installation: IPP - Intermountain Power Project

Building No.: 9BSE-G Section: 9BSEGC Area: 288 Sq.Ft.

Last Replacement: Original Construction: 1985
Occupancy: Maintenance

Perimeter
Parapet: 72 Ft. Exp. Joint: Ft. Adj. Wall: Ft.
Roof Edge: Ft. Area Div.: Ft. Other: Ft.
Access: EXTERNAL LADDER: Temporary Adj Roof Sec:

Structural Frame: STEEL: Bar Joists/Beams & Columns

Roof Deck: STEEL
Slope: 1/4
Drainage: INTERIOR DRAINS

Vapor Retarder: UNKNOWN

Insulation: EXPANDED POLYSTYRENE
Thickness: 4 In. Layers: 2 Tapered: N
R-Value: 19
Attachment: ADHESIVE - HOT

Membrane: Mfg: Spec. No.:
Description:
Protected Mem.: N
Type: BUR: Asphalt
Attachment: FULLY ADHERED
Reinforcement: B.U.(HOT/COLD): Glass Felt
Surfacing: AGG: Pea Gravel
Walkways: ASPHALT PLANK

Base Flashing: REINFORCED ASBESTOS
Flashing Adhesive: HOT MOPPED
Counterflashing: METAL
Types: WALL/PARAPET

Remarks:

Installation: IPP - Intermountain Power Project

Building No.: 9BSE-G Section: 9BSEGD Area: 1800 Sq.Ft.

Last Replacement: Original Construction: 1985
Occupancy: Maintenance

Perimeter
Parapet: 30 Ft. Exp. Joint: 120 Ft. Adj. Wall: 30 Ft.
Roof Edge: Ft. Area Div.: Ft. Other: Ft.
Access: PENTHOUSE Adj Roof Sec:

Structural Frame: STEEL: Bar Joists/Beams & Columns

Roof Deck: STEEL
Slope: 1/4
Drainage: INTERIOR DRAINS

Vapor Retarder: UNKNOWN

Insulation: EXPANDED POLYSTYRENE
Thickness: 4 In. Layers: 2 Tapered: N
R-Value: 19
Attachment: ADHESIVE - HOT

Membrane: Mfg: Spec. No.:
Description:
Protected Mem.: N
Type: BUR: Asphalt
Attachment: FULLY ADHERED
Reinforcement: B.U.(HOT/COLD): Glass Felt
Surfacing: AGG: Pea Gravel
Walkways: ASPHALT PLANK

Base Flashing: REINFORCED ASBESTOS
Flashing Adhesive: HOT MOPPED
Counterflashing: METAL
Types: WALL/PARAPET

Remarks:

Installation: IPP - Intermountain Power Project

Building No.: 9BSE-G Section: 9BSEGE Area: 5540 Sq.Ft.

Last Replacement: Original Construction: 1985
Occupancy: Maintenance

Perimeter

Parapet:	152	Ft.	Exp. Joint:	90	Ft.	Adj. Wall:	30	Ft.
Roof Edge:		Ft.	Area Div.:	20	Ft.	Other:		Ft.

Access: PENTHOUSE Adj Roof Sec:

Structural Frame: STEEL: Bar Joists/Beams & Columns

Roof Deck: STEEL
Slope: 1/4
Drainage: INTERIOR DRAINS

Vapor Retarder: UNKNOWN

Insulation: EXPANDED POLYSTYRENE
Thickness: 4 In. Layers: 2 Tapered: N
R-Value: 19
Attachment: ADHESIVE - HOT

Membrane: Mfg: Spec. No.:
Description:
Protected Mem.: N
Type: BUR: Asphalt
Attachment: FULLY ADHERED
Reinforcement: B.U.(HOT/COLD): Glass Felt
Surfacing: AGG: Pea Gravel
Walkways: ASPHALT PLANK

Base Flashing: REINFORCED ASBESTOS
Flashing Adhesive: HOT MOPPED
Counterflashing: METAL
Types: WALL/PARAPET

Remarks:

Installation: IPP - Intermountain Power Project

Building No.: 9BSE-G Section: 9BSEGF Area: 3740 Sq.Ft.

Last Replacement: Original Construction: 1985
Occupancy: Maintenance

Perimeter

Parapet:	60	Ft.	Exp. Joint:	150	Ft.	Adj. Wall:	90 Ft.
Roof Edge:		Ft.	Area Div.:		Ft.	Other:	Ft.

Access: PENTHOUSE Adj Roof Sec:

Structural Frame: STEEL: Bar Joists/Beams & Columns

Roof Deck: STEEL
Slope: 1/4
Drainage: INTERIOR DRAINS

Vapor Retarder: UNKNOWN

Insulation: EXPANDED POLYSTYRENE
Thickness: 4 In. Layers: 2 Tapered: N
R-Value: 19
Attachment: ADHESIVE - HOT

Membrane: Mfg: Spec. No.:
Description:
Protected Mem.: N
Type: BUR: Asphalt
Attachment: FULLY ADHERED
Reinforcement: B.U.(HOT/COLD): Glass Felt
Surfacing: AGG: Pea Gravel
Walkways: ASPHALT PLANK

Base Flashing: REINFORCED ASBESTOS
Flashing Adhesive: HOT MOPPED
Counterflashing: METAL
Types: WALL/PARAPET

Remarks:

Installation: IPP - Intermountain Power Project

Building No.: 9BSE-G Section: 9BSEGG Area: 4920 Sq.Ft.

Last Replacement: Original Construction: 1985
Occupancy: Maintenance

Perimeter
Parapet: Ft. Exp. Joint: 300 Ft. Adj. Wall: Ft.
Roof Edge: Ft. Area Div.: Ft. Other: Ft.
Access: PENTHOUSE Adj Roof Sec:

Structural Frame: STEEL: Bar Joists/Beams & Columns

Roof Deck: STEEL
Slope: 1/4
Drainage: INTERIOR DRAINS

Vapor Retarder: UNKNOWN

Insulation: EXPANDED POLYSTYRENE
Thickness: 4 In. Layers: 2 Tapered: N
R-Value: 19
Attachment: ADHESIVE - HOT

Membrane: Mfg: Spec. No.:
Description:
Protected Mem.: N
Type: BUR: Asphalt
Attachment: FULLY ADHERED
Reinforcement: B.U.(HOT/COLD): Glass Felt
Surfacing: AGG: Pea Gravel
Walkways: ASPHALT PLANK

Base Flashing: REINFORCED ASBESTOS
Flashing Adhesive: HOT MOPPED
Counterflashing: METAL
Types: WALL/PARAPET

Remarks:

Installation: IPP - Intermountain Power Project

Building No.: 9BSE-G Section: 9BSEGH Area: 4920 Sq.Ft.

Last Replacement: Original Construction: 1985
Occupancy: Maintenance

Perimeter
Parapet: Ft. Exp. Joint: 260 Ft. Adj. Wall: 80 Ft.
Roof Edge: Ft. Area Div.: Ft. Other: Ft.
Access: PENTHOUSE Adj Roof Sec:

Structural Frame: STEEL: Bar Joists/Beams & Columns

Roof Deck: STEEL
Slope: 1/4
Drainage: INTERIOR DRAINS

Vapor Retarder: UNKNOWN

Insulation: EXPANDED POLYSTYRENE
Thickness: 4 In. Layers: 2 Tapered: N
R-Value: 19
Attachment:

Membrane: Mfg: Spec. No.:
Description:
Protected Mem.: N
Type: BUR: Asphalt
Attachment: FULLY ADHERED
Reinforcement: B.U.(HOT/COLD): Glass Felt
Surfacing: AGG: Pea Gravel
Walkways: ASPHALT PLANK

Base Flashing: REINFORCED ASBESTOS
Flashing Adhesive: HOT MOPPED
Counterflashing: METAL
Types: WALL/PARAPET

Remarks:

Installation: IPP - Intermountain Power Project

Building No.: 9BSE-G Section: 9BSEGI Area: 5400 Sq.Ft.
Last Replacement: Original Construction: 1985
Occupancy: Maintenance

Perimeter
Parapet: 60 Ft. Exp. Joint: 210 Ft. Adj. Wall: 90 Ft.
Roof Edge: Ft. Area Div.: Ft. Other: Ft.
Access: PENTHOUSE Adj Roof Sec:

Structural Frame: STEEL: Bar Joists/Beams & Columns

Roof Deck:
Slope: 1/4
Drainage: INTERIOR DRAINS

Vapor Retarder: UNKNOWN

Insulation: EXPANDED POLYSTYRENE
Thickness: 4 In. Layers: 1 Tapered: N
R-Value: 19
Attachment: ADHESIVE - HOT

Membrane: Mfg: Spec. No.:
Description:
Protected Mem.: N
Type: BUR: Asphalt
Attachment: FULLY ADHERED
Reinforcement: B.U.(HOT/COLD): Glass Felt
Surfacing: AGG: Pea Gravel
Walkways: ASPHALT PLANK

Base Flashing: REINFORCED ASBESTOS
Flashing Adhesive: HOT MOPPED
Counterflashing: METAL
Types: WALL/PARAPET

Remarks:

Installation: IPP - Intermountain Power Project

Building No.: 9BSE-G Section: 9BSEGJ Area: 1870 Sq.Ft.
Last Replacement: Original Construction: 1985
Occupancy: Maintenance

Perimeter
Parapet: 30 Ft. Exp. Joint: 120 Ft. Adj. Wall: 30 Ft.
Roof Edge: Ft. Area Div.: Ft. Other: Ft.
Access: PENTHOUSE Adj Roof Sec:

Structural Frame: STEEL: Bar Joists/Beams & Columns

Roof Deck: STEEL
Slope: 1/4
Drainage: INTERIOR DRAINS

Vapor Retarder: UNKNOWN

Insulation: EXPANDED POLYSTYRENE
Thickness: 4 In. Layers: 1 Tapered: N
R-Value: 19
Attachment: ADHESIVE - HOT

Membrane: Mfg: Spec. No.:
Description:
Protected Mem.: N
Type: BUR: Asphalt
Attachment: FULLY ADHERED
Reinforcement: B.U.(HOT/COLD): Glass Felt
Surfacing: AGG: Pea Gravel
Walkways: ASPHALT PLANK

Base Flashing: REINFORCED ASBESTOS
Flashing Adhesive: HOT MOPPED
Counterflashing: METAL
Types: WALL/PARAPET

Remarks:

Installation: IPP - Intermountain Power Project

Building No.: 9BSE-G Section: 9BSEGK Area: 3158 Sq.Ft.

Last Replacement: Original Construction: 1985
Occupancy: Maintenance

Perimeter
Parapet: Ft. Exp. Joint: 150 Ft. Adj. Wall: 180 Ft.
Roof Edge: Ft. Area Div.: Ft. Other: Ft.
Access: PENTHOUSE Adj Roof Sec:

Structural Frame: STEEL: Bar Joists/Beams & Columns

Roof Deck: STEEL
Slope: 1/4
Drainage: INTERIOR DRAINS

Vapor Retarder: UNKNOWN

Insulation: EXPANDED POLYSTYRENE
Thickness: 4 In. Layers: 1 Tapered: N
R-Value: 19
Attachment: LOOSE LAID

Membrane: Mfg: Spec. No.:
Description:
Protected Mem.: N
Type: BUR: Asphalt
Attachment: FULLY ADHERED
Reinforcement: B.U.(HOT/COLD): Glass Felt
Surfacing: AGG: Pea Gravel
Walkways: ASPHALT PLANK

Base Flashing: REINFORCED ASBESTOS
Flashing Adhesive: HOT MOPPED
Counterflashing: METAL
Types: WALL/PARAPET

Remarks:

Installation: IPP - Intermountain Power Project

Building No.: 9BSE-G Section: 9BSEGL Area: 8100 Sq.Ft.
Last Replacement: Original Construction: 1985
Occupancy: Maintenance

Perimeter
Parapet: Ft. Exp. Joint: 360 Ft. Adj. Wall: 120 Ft.
Roof Edge: Ft. Area Div.: Ft. Other: Ft.
Access: PENTHOUSE Adj Roof Sec:

Structural Frame: STEEL: Bar Joists/Beams & Columns

Roof Deck: STEEL
Slope: 1/4
Drainage: INTERIOR DRAINS

Vapor Retarder: UNKNOWN

Insulation: EXPANDED POLYSTYRENE
Thickness: 4 In. Layers: 1 Tapered: N
R-Value: 19
Attachment: ADHESIVE - HOT

Membrane: Mfg: Spec. No.:
Description:
Protected Mem.: N
Type: BUR: Asphalt
Attachment: FULLY ADHERED
Reinforcement: B.U.(HOT/COLD): Glass Felt
Surfacing: AGG: Pea Gravel
Walkways: ASPHALT PLANK

Base Flashing: REINFORCED ASBESTOS
Flashing Adhesive: HOT MOPPED
Counterflashing: METAL
Types: WALL/PARAPET

Remarks:

Installation: IPP - Intermountain Power Project

Building No.: 9BSE-G Section: 9BSEGM Area: 8100 Sq.Ft.

Last Replacement: Original Construction: 1985
Occupancy: Maintenance

Perimeter
Parapet: Ft. Exp. Joint: 360 Ft. Adj. Wall: 120 Ft.
Roof Edge: Ft. Area Div.: Ft. Other: Ft.
Access: PENTHOUSE Adj Roof Sec:

Structural Frame: STEEL: Bar Joists/Beams & Columns

Roof Deck: STEEL
Slope: 1/4
Drainage: INTERIOR DRAINS

Vapor Retarder: UNKNOWN

Insulation: EXPANDED POLYSTYRENE
Thickness: 4 In. Layers: 1 Tapered: N
R-Value: 19
Attachment: ADHESIVE - HOT

Membrane: Mfg: Spec. No.:
Description:
Protected Mem.: N
Type: BUR: Asphalt
Attachment: FULLY ADHERED
Reinforcement: B.U.(HOT/COLD): Glass Felt
Surfacing: AGG: Pea Gravel
Walkways: ASPHALT PLANK

Base Flashing: REINFORCED ASBESTOS
Flashing Adhesive: HOT MOPPED
Counterflashing: METAL
Types: WALL/PARAPET

Remarks:

Installation: IPP - Intermountain Power Project

Building No.: 9BSE-G Section: 9BSEGN Area: 8100 Sq.Ft.

Last Replacement: Original Construction: 1985
Occupancy: Maintenance

Perimeter
Parapet: 90 Ft. Exp. Joint: 270 Ft. Adj. Wall: Ft.
Roof Edge: Ft. Area Div.: Ft. Other: Ft.
Access: PENTHOUSE Adj Roof Sec:

Structural Frame: STEEL: Bar Joists/Beams & Columns

Roof Deck: STEEL
Slope: 1/4
Drainage: INTERIOR DRAINS

Vapor Retarder: UNKNOWN

Insulation: EXPANDED POLYSTYRENE
Thickness: 4 In. Layers: 1 Tapered: N
R-Value: 19
Attachment: ADHESIVE - HOT

Membrane: Mfg: Spec. No.:
Description:
Protected Mem.: N
Type: BUR: Asphalt
Attachment: FULLY ADHERED
Reinforcement: B.U.(HOT/COLD): Glass Felt
Surfacing: AGG: Pea Gravel
Walkways: ASPHALT PLANK

Base Flashing: REINFORCED ASBESTOS
Flashing Adhesive: HOT MOPPED
Counterflashing: METAL
Types: WALL/PARAPET

Remarks:

Installation: IPP - Intermountain Power Project

Building No.: 9BSE-G Section: 9BSEGO Area: 8156 Sq.Ft.

Last Replacement: Original Construction: 1985
Occupancy: Maintenance

Perimeter
Parapet: 180 Ft. Exp. Joint: 180 Ft. Adj. Wall: 120 Ft.
Roof Edge: Ft. Area Div.: Ft. Other: Ft.
Access: Adj Roof Sec:

Structural Frame: STEEL: Bar Joists/Beams & Columns

Roof Deck: STEEL
Slope: 1/4
Drainage: INTERIOR DRAINS

Vapor Retarder: UNKNOWN

Insulation: EXPANDED POLYSTYRENE
Thickness: 4 In. Layers: 1 Tapered: N
R-Value: 19
Attachment: ADHESIVE - HOT

Membrane: Mfg: Spec. No.:
Description:
Protected Mem.: N
Type: BUR: Asphalt
Attachment: FULLY ADHERED
Reinforcement: B.U.(HOT/COLD): Glass Felt
Surfacing: AGG: Pea Gravel
Walkways: ASPHALT PLANK

Base Flashing: REINFORCED ASBESTOS
Flashing Adhesive:
Counterflashing: METAL
Types: WALL/PARAPET

Remarks:

Installation: IPP - Intermountain Power Project

Building No.: 9BSE-G Section: 9BSEGP Area: 7950 Sq.Ft.

Last Replacement: Original Construction: 1985
Occupancy: Maintenance

Perimeter
Parapet: 90 Ft. Exp. Joint: 270 Ft. Adj. Wall: 120 Ft.
Roof Edge: Ft. Area Div.: Ft. Other: Ft.
Access: PENTHOUSE Adj Roof Sec:

Structural Frame: STEEL: Bar Joists/Beams & Columns

Roof Deck:
Slope: 1/4
Drainage: INTERIOR DRAINS

Vapor Retarder: UNKNOWN

Insulation: EXPANDED POLYSTYRENE
Thickness: 4 In. Layers: 1 Tapered: N
R-Value: 19
Attachment: ADHESIVE - HOT

Membrane: Mfg: Spec. No.:
Description:
Protected Mem.: N
Type: BUR: Asphalt
Attachment: FULLY ADHERED
Reinforcement: B.U.(HOT/COLD): Glass Felt
Surfacing: AGG: Pea Gravel
Walkways: ASPHALT PLANK

Base Flashing: REINFORCED ASBESTOS
Flashing Adhesive: HOT MOPPED
Counterflashing: METAL
Types: WALL/PARAPET

Remarks:

Installation: IPP - Intermountain Power Project

Building No.: 9BSE-G Section: 9BSEGQ Area: 7950 Sq.Ft.

Last Replacement: Original Construction: 1985
Occupancy: Maintenance

Perimeter

Parapet:	90	Ft.	Exp. Joint:	270	Ft.	Adj. Wall:	120	Ft.
Roof Edge:		Ft.	Area Div.:		Ft.	Other:		Ft.

Access: PENTHOUSE Adj Roof Sec:

Structural Frame: STEEL: Bar Joists/Beams & Columns

Roof Deck: STEEL
Slope: 1/4
Drainage: INTERIOR DRAINS

Vapor Retarder: UNKNOWN

Insulation: EXPANDED POLYSTYRENE
Thickness: 4 In. Layers: 1 Tapered: N
R-Value: 19
Attachment: ADHESIVE - HOT

Membrane: Mfg: Spec. No.:
Description:
Protected Mem.: N
Type: BUR: Asphalt
Attachment: FULLY ADHERED
Reinforcement: B.U.(HOT/COLD): Glass Felt
Surfacing: AGG: Slag
Walkways: ASPHALT PLANK

Base Flashing: REINFORCED ASBESTOS
Flashing Adhesive: HOT MOPPED
Counterflashing: METAL
Types: WALL/PARAPET

Remarks:

Installation: IPP - Intermountain Power Project

Building No.: 9BSE-G Section: 9BSEGR Area: 2650 Sq.Ft.

Last Replacement: Original Construction: 1985
Occupancy: Maintenance

Perimeter

Parapet:	30	Ft.	Exp. Joint:	118	Ft.	Adj. Wall:	88	Ft.
Roof Edge:		Ft.	Area Div.:		Ft.	Other:		Ft.

Access: PENTHOUSE Adj Roof Sec:

Structural Frame: STEEL: Bar Joists/Beams & Columns

Roof Deck: STEEL
Slope: 1/4
Drainage: INTERIOR DRAINS

Vapor Retarder: UNKNOWN

Insulation: EXPANDED POLYSTYRENE
Thickness: 4 In. Layers: 1 Tapered: N
R-Value: 19
Attachment: LOOSE LAID

Membrane: Mfg: Spec. No.:
Description:
Protected Mem.: N
Type: BUR: Asphalt
Attachment: FULLY ADHERED
Reinforcement: B.U.(HOT/COLD): Glass Felt
Surfacing: AGG: Pea Gravel
Walkways: ASPHALT PLANK

Base Flashing: REINFORCED ASBESTOS
Flashing Adhesive: HOT MOPPED
Counterflashing: METAL
Types: WALL/PARAPET

Remarks:

ROOF INSPECTION WORKSHEET

Copies of the actual roof inspection drawings are included to show the size of each section of the roof and the location of equipment, access and defects. The drawing can be used to guide repairmen to the defects and compare the condition of the roof this year with subsequent years.

The defects typically include base flashings (BF), ponding (PD), roof drains (DR), surface deterioration (SP), metal caps (MC) and debris on the roof (DV). Each defect has a severity listed: low, medium or high. Defects are identified by comparing the actual on-site conditions with photographs of defects in the guidebook.

Thus, the information entered into the MicroRoofer program is consistent with all other information gathered for other projects. The results are, therefore, very subjective and do not vary from inspector to inspector.

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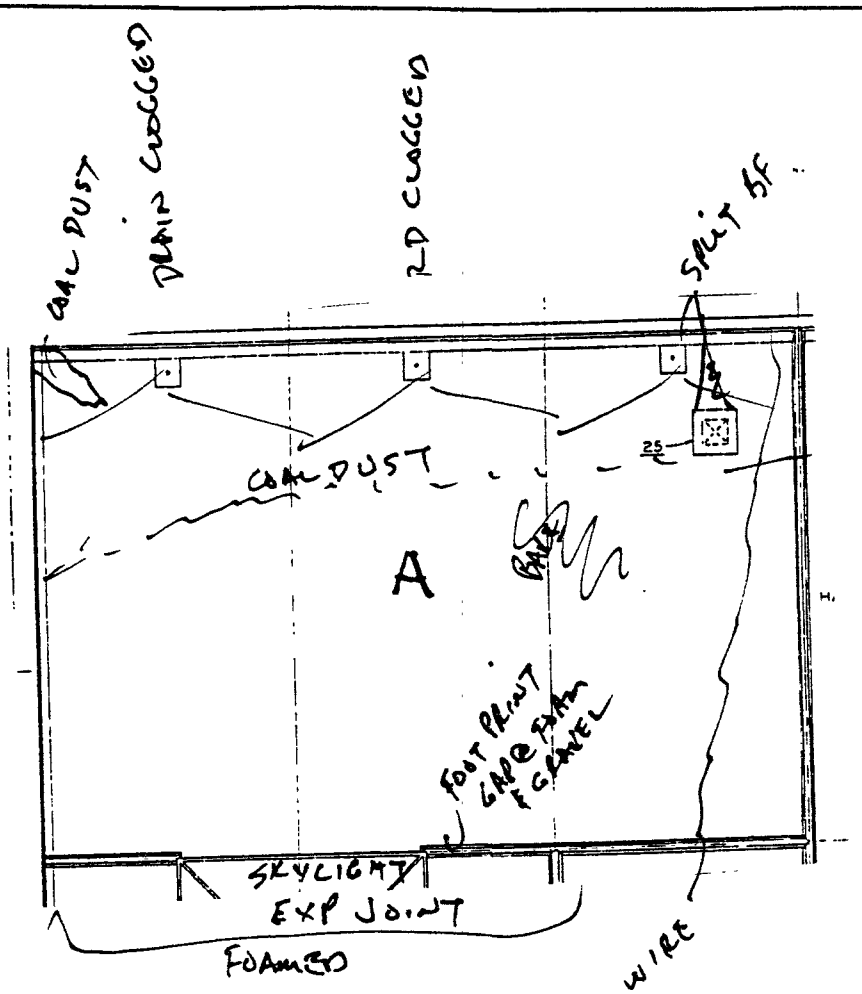
IPP

ROOF INSPECTION WORKSHEET	AGENCY/INST.:
BUILDING General Services PER. FLASHING 304 LF	DATE
SECTION A CURB FLASHING LF	NAME

BF-BASE FLASH	PP-PITCH PANS	SP-SPLITS	PA-PATCHING
MC-METAL CAP	DR-DRAIN & SC	HL-HOLES	DV-DEBRIS & VEG
EM-EMBEDD MET	BL-BLISTERS	SR-SURF DET	EQ-EQ SUPPORT
FP-FLASHED PEN	RG-RIDGES	SL-SLIPPAGE	PD-PONDING



NO CRICKETS
MOD DETER BF

184
120
304

ID #	DIS	SEV	DEF	QTY
BF	2	L		304
BF	13	H		2
PA	3	M		60'
RD	2	M		3
RD	6	H		2
BF	2	L		304
BF	3	L		304
BF	2	M		304
BF	1	H		2
PA	1	M		60
DR	1	M		3
DR	3	H		2

SCALE: _____

NORTH

IP12_004331

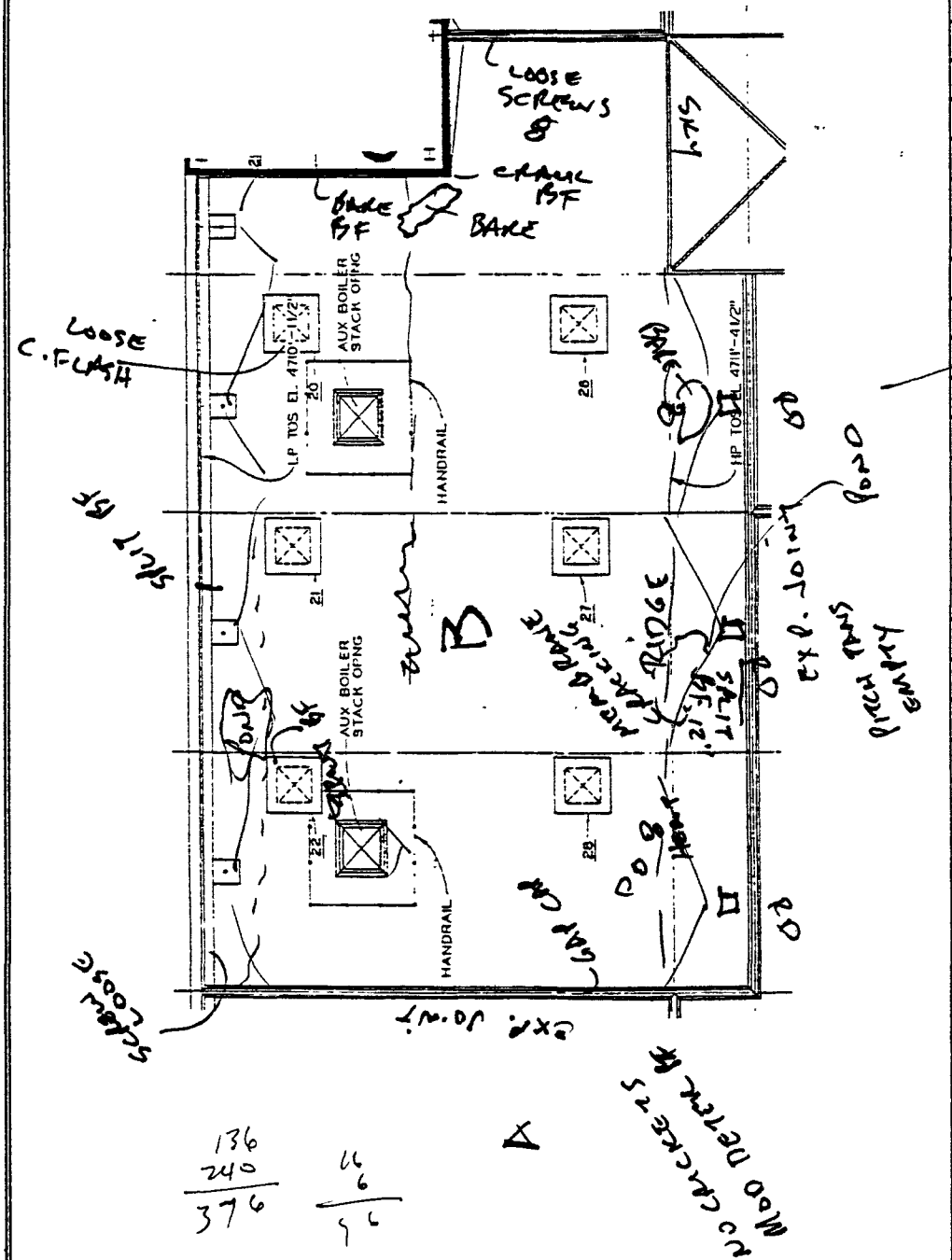
I PP

ROOF INSPECTION WORKSHEET	AGENCY/INST.:

BUILDING General Services PER. FLASHING 376 LF DATE _____

SECTION B CURB FLASHING 96 LF NAME _____

BF-BASE FLASH	PP-PITCH PANS	SP-SPLITS	PA-PATCHING
MC-METAL CAP	DR-DRAIN & SC	HL-HOLES	DV-DEBRIS & VEG
EM-EMBEDD MET	BL-BLISTERS	SR-SURF DET	EQ-EQ SUPPORT
FP-FLASHED PEN	RG-RIDGES	SL-SLIPPAGE	PD-PONDING



136
240
376

96
96

SCALE: _____

ID #	DIS	SEV	DEF	QTY	
BF	2	L		376	
BF	2	L		96	
BF	13	H		~~8~~	3
BF	12	H		12	
PD	6	L		360	
PP	9	H		2	
SR	9	M		16	
RD	2	M		4	
BF	2	L		472	
BF	3	L		472	
BF	2	M		472	
BF	1	H		~~5~~	3
BF	2	H		12	
PD	1	L		360	
PP	2	H		2	
SR	1	M		16	
DR	1	M		4	

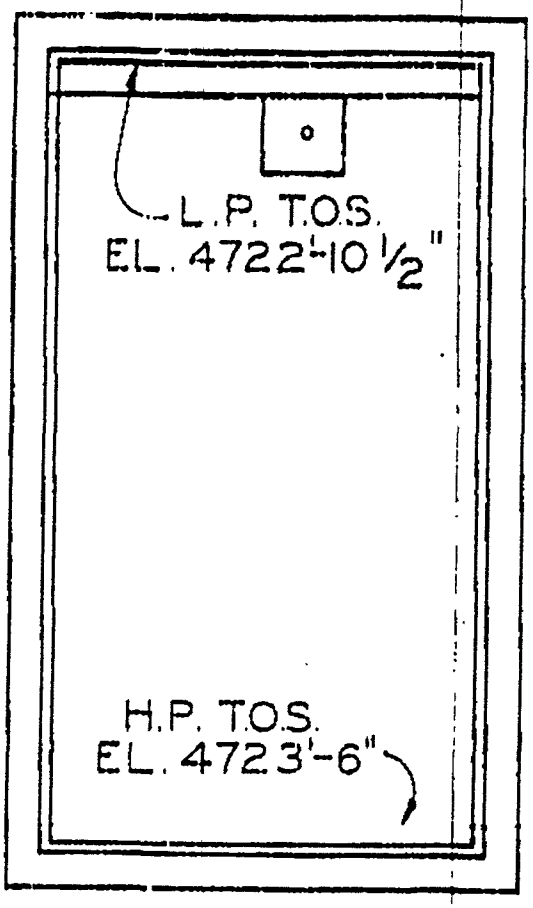
NORTH

IP12_004332

IPP

ROOF INSPECTION WORKSHEET	AGENCY/INST.:
BUILDING General Services PER. FLASHING 96 LF	DATE
SECTION C CURB FLASHING LF	NAME

BF-BASE FLASH	PP-PITCH PANS	SP-SPLITS	PA-PATCHING
MC-METAL CAP	DR-DRAIN & SC	HL-HOLES	DV-DEBRIS & VEG
EM-EMBEDD MET	BL-BLISTERS	SR-SURF DET	EQ-EQ SUPPORT
FP-FLASHED PEN	RG-RIDGES	SL-SLIPPAGE	PD-PONDING



PENTHOUSE ROOF PLAN

SCALE: _____

ID #	DIS	SEV	DEF	QTY
BF	2	L		96
RD	2	M		1
BF	2	L		96
BF	3	L		96
BF	2	M		96
DR	1	M		1

NORTH

IP12_004333

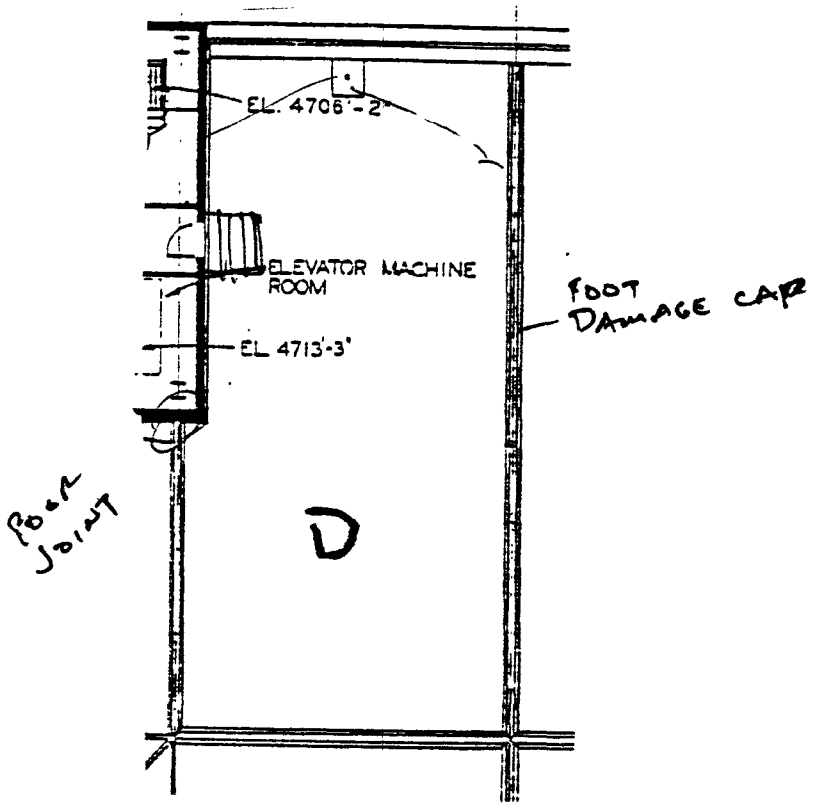
IPP

ROOF INSPECTION WORKSHEET	AGENCY/INST.:

BUILDING General Services PER. FLASHING 180 LF DATE

SECTION D CURB FLASHING LF NAME

BF-BASE FLASH	PP-PITCH PANS	SP-SPLITS	PA-PATCHING
MC-METAL CAP	DR-DRAIN & SC	HL-HOLES	DV-DEBRIS & VEG
EM-EMBEDD MET	BL-BLISTERS	SR-SURF DET	EQ-EQ SUPPORT
FP-FLASHED PEN	RG-RIDGES	SL-SLIPPAGE	PD-PONDING



NO CRICKET
MOD DETER BF

ID #	DIS	SEV	DEF	QTY
BF	2	L		180
MC	5	L		1
BF	2	L		180
BF	2	L		180
BF	2	M		180
MC	2	L		5

SCALE: _____

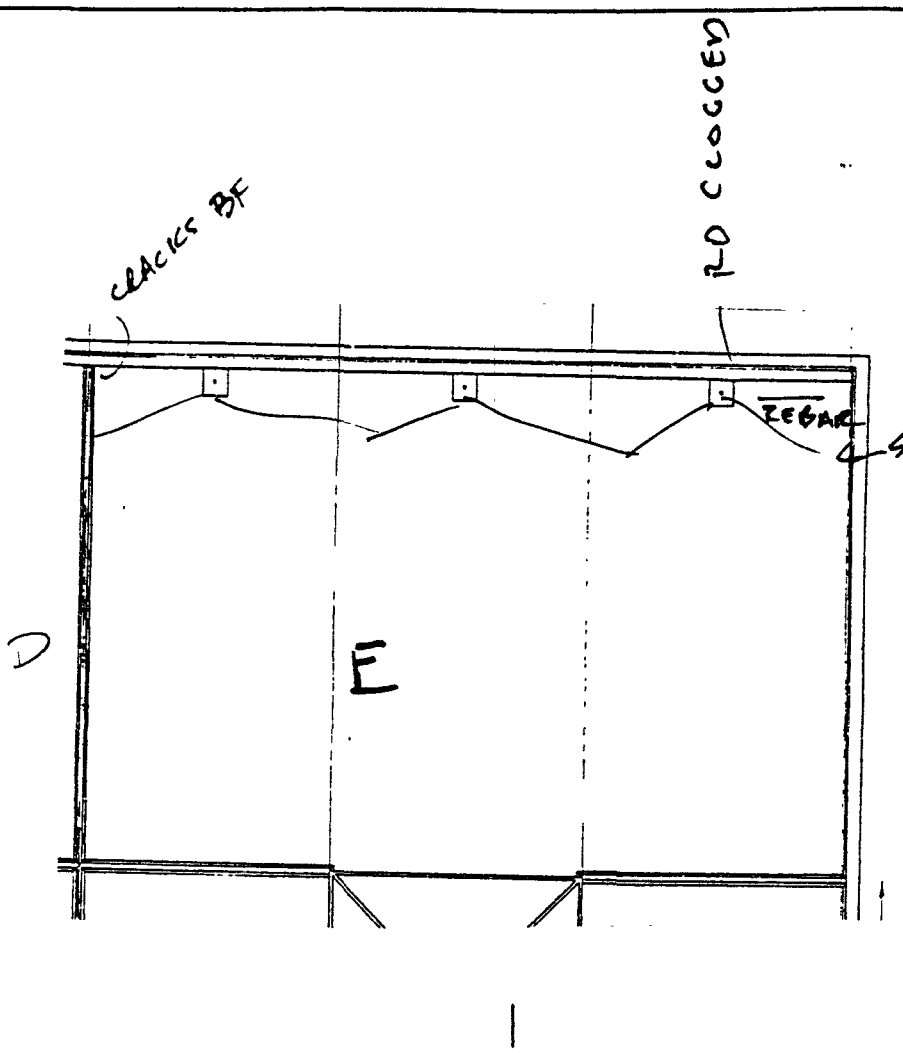
NORTH

IP12_004334

IPP

ROOF INSPECTION WORKSHEET	AGENCY/INST.:
BUILDING General Services PER. FLASHING 304 LF	DATE
SECTION F CURB FLASHING LF	NAME

BF-BASE FLASH	PP-PITCH PANS	SP-SPLITS	PA-PATCHING
MC-METAL CAP	DR-DRAIN & SC	HL-HOLES	DV-DEBRIS & VEG
EM-EMBEDD MET	BL-BLISTERS	SR-SURF DET	EQ-EQ SUPPORT
FP-FLASHED PEN	RG-RIDGES	SL-SLIPPAGE	PD-PONDING



NO CRICKETS

MOD DETEL BF

184½ / 368

120 / 184 / 304

ID #	DIS	SEV	DEF	QTY
BF	2	L		304
RD	2	M		3
RD	6	H		1
PD	6	L		368
BF	2	L		304
BF	3	L		304
BF	2	M		304
DR	1	M		3
DR	3	H		1
PD	1	L		368

SCALE: _____

NORTH

IP12_004335

TPP

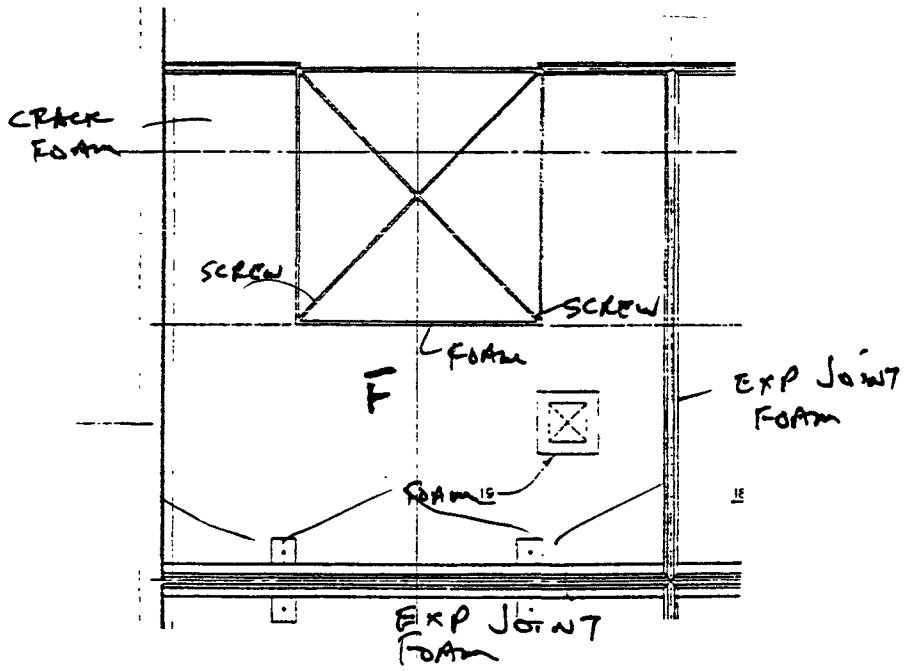
ROOF INSPECTION WORKSHEET	AGENCY/INST.:

BUILDING General Services PER. FLASHING 244 LF DATE _____

SECTION F CURB FLASHING 90 LF NAME _____

BF-BASE FLASH	PP-PITCH PANS	SP-SPLITS	PA-PATCHING
MC-METAL CAP	DR-DRAIN & SC	HL-HOLES	DV-DEBRIS & VEG
EM-EMBEDD MET	BL-BLISTERS	SR-SURF DET	EQ-EQ SUPPORT
FP-FLASHED PEN	RG-RIDGES	SL-SLIPPAGE	PD-PONDING

ID #	DIS	SEV	DEF	QTY
BF	2	L		~~244~~ 244
BF	2	L		90
PA	3	M		3740
BF	2	L		334
BF	3	L		344
BF	2	M		344
PA	1	M		3740



NO CRICKETS
GAPS @ GRAVEL & FOAM

SCALE: _____

NORTH

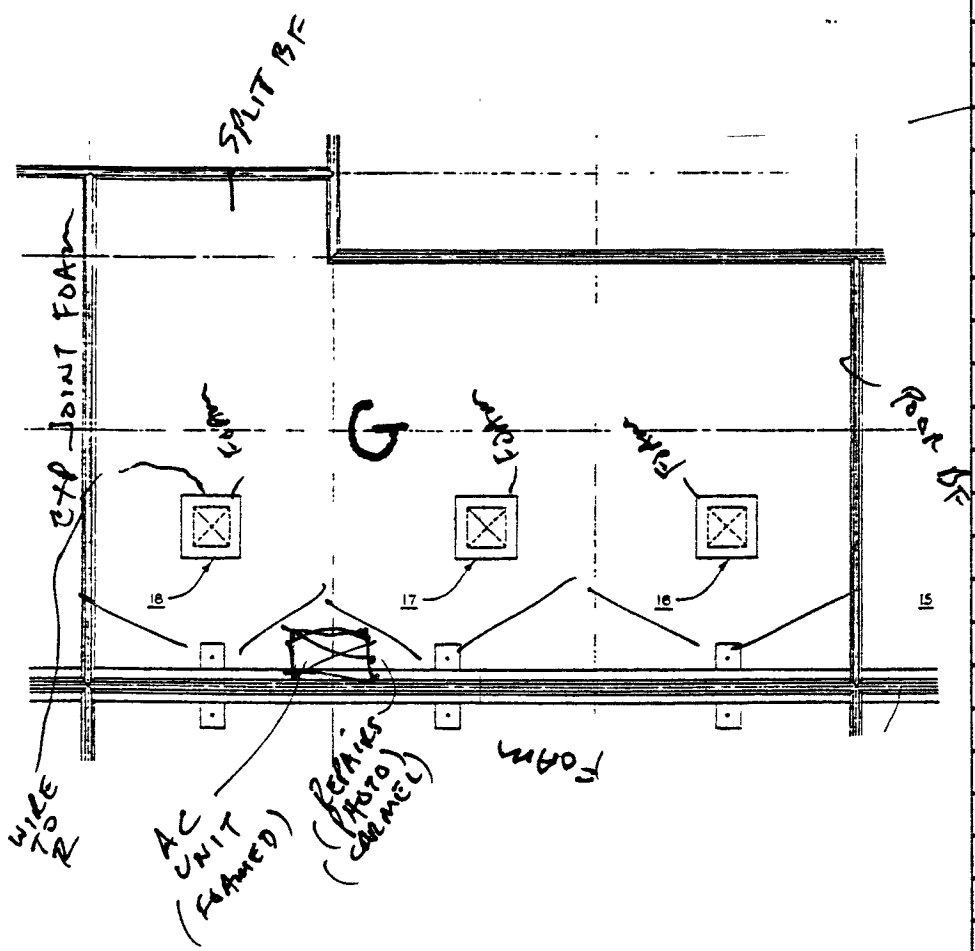
IP12_004336

I PP

ROOF INSPECTION WORKSHEET	AGENCY/INST.:
BUILDING General Service PER. FLASHING 300 LF	DATE
SECTION G CURB FLASHING 48 LF	NAME

BF-BASE FLASH	PP-PITCH PANS	SP-SPLITS	PA-PATCHING
MC-METAL CAP	DR-DRAIN & SC	HL-HOLES	DV-DEBRIS & VEG
EM-EMBEDD MET	BL-BLISTERS	SR-SURF DET	EQ-EQ SUPPORT
FP-FLASHED PEN	RG-RIDGES	SL-SLIPPAGE	PD-PONDING

ID #	DIS	SEV	DEF	QTY
BF	2	L		300
BF	2	L		48
BF	13	H		1
PA	3	M		~~5400~~ 4920
BF	2	L		348
BF	3	L		348
BF	2	M		348
BF	1	H		1
PA	1	M		~~4920~~ 160



180
120
300

SCALE: _____

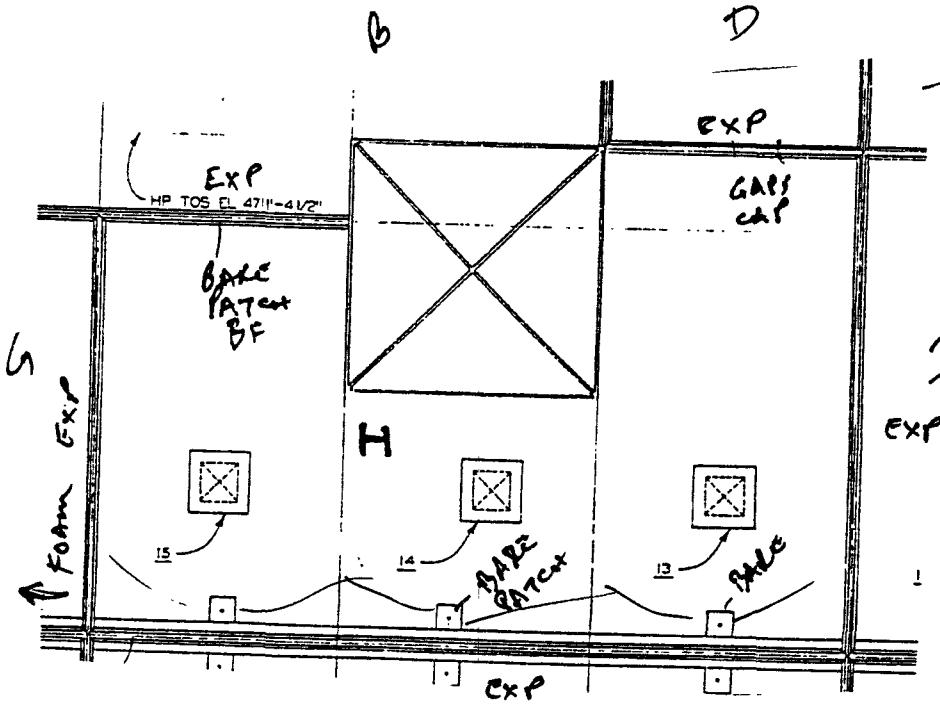
NORTH

IP12_004337

I P7

ROOF INSPECTION WORKSHEET	AGENCY/INST.:
BUILDING General Services PER. FLASHING 400 LF	DATE
SECTION H CURB FLASHING ____ LF	NAME

BF-BASE FLASH	PP-PITCH PANS	SP-SPLITS	PA-PATCHING
MC-METAL CAP	DR-DRAIN & SC	HL-HOLES	DV-DEBRIS & VEG
EM-EMBEDD MET	BL-BLISTERS	SR-SURF DET	EQ-EQ SUPPORT
FP-FLASHED PEN	RG-RIDGES	SL-SLIPPAGE	PD-PONDING



No CRICKETS
Mod DETERIOR BF

ID #	DIS	SEV	DEF	QTY
BF	2	L		400
BF	2	L		80
RD	2	M		3
PD	6	L		360
BF	2	L		400
BF	3	L		400
BF	2	M		400
~~BF~~				
PD	1	L		360
DR	1	M		3

SCALE: _____

NORTH

IP12_004338

IPP

ROOF INSPECTION WORKSHEET	AGENCY/INST.:
BUILDING General Services	PER. FLASHING 400 LF
SECTION I	CURB FLASHING 122 ~~130~~ LF

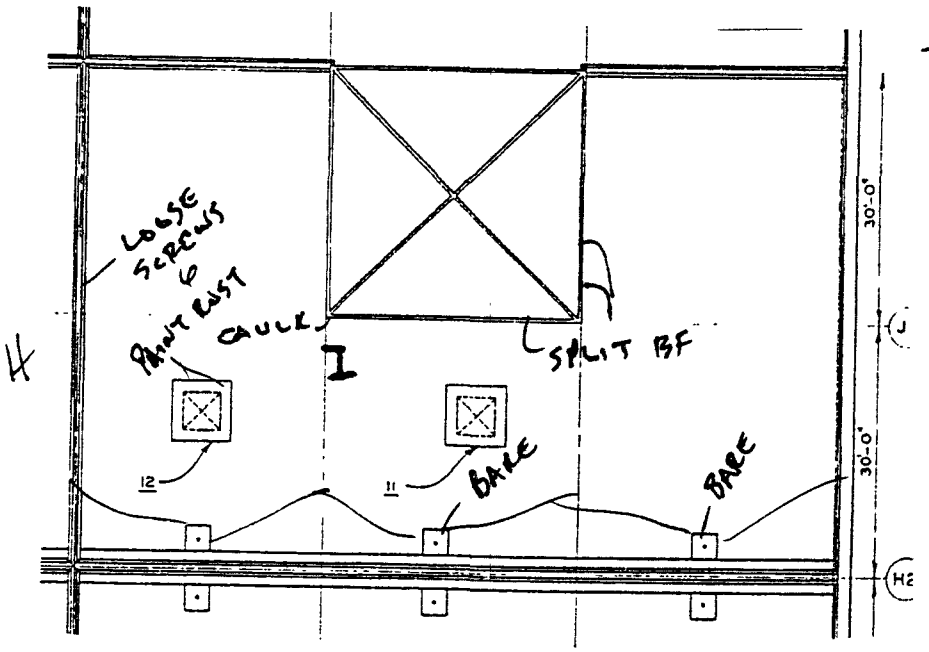
DATE _____

NAME _____

BF-BASE FLASH	PP-PITCH PANS	SP-SPLITS	PA-PATCHING
MC-METAL CAP	DR-DRAIN & SC	HL-HOLES	DV-DEBRIS & VEG
EM-EMBEDD MET	BL-BLISTERS	SR-SURF DET	EQ-EQ SUPPORT
FP-FLASHED PEN	RG-RIDGES	SL-SLIPPAGE	PD-PONDING

ID #	DIS	SEV	DEF	QTY
BF	2	L		400
BF	2	L		122
BF	13	H		3
RD	2	M		3
PD	6	L		360
BF	2	L		522
BF	3	L		522
BF	2	M		522
BF	1	H		3
DR	1	M		3
PD	1	L		360

D



NO CLICKETS
MOD DETERIOR BF

SCALE: _____

NORTH

IP12_004339

IPP

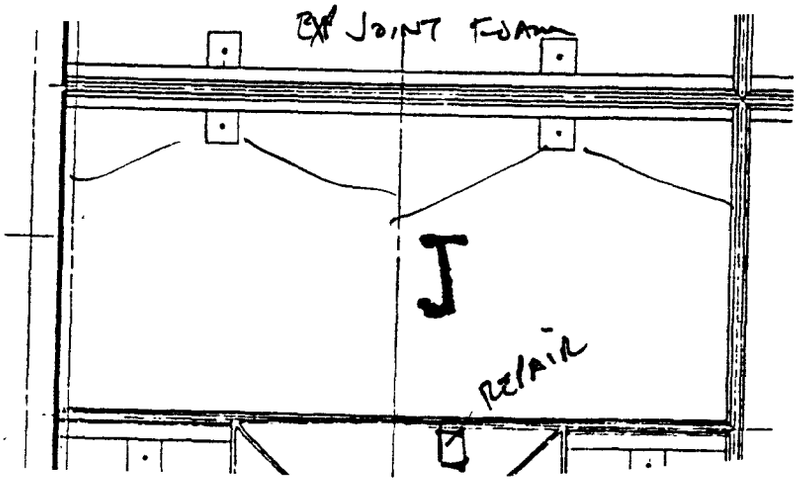
ROOF INSPECTION WORKSHEET	AGENCY/INST.:

BUILDING General Services PER. FLASHING 184 LF DATE _____

SECTION J CURB FLASHING _____ LF NAME _____

BF-BASE FLASH	PP-PITCH PANS	SP-SPLITS	PA-PATCHING
MC-METAL CAP	DR-DRAIN & SC	HL-HOLES	DV-DEBRIS & VEG
EM-EMBEDD MET	BL-BLISTERS	SR-SURF DET	EQ-EQ SUPPORT
FP-FLASHED PEN	RG-RIDGES	SL-SLIPPAGE	PD-PONDING

ID #	DIS	SEV	DEF	QTY
BF	2	L		184
RD	2	M		2
PA	3	M		62
BF	2	L		184
BF	3	L		184
BF	2	M		184
DR	1	M		2
PA	1	M		62



NO CRICKETS

SCALE: _____

NORTH

IPP

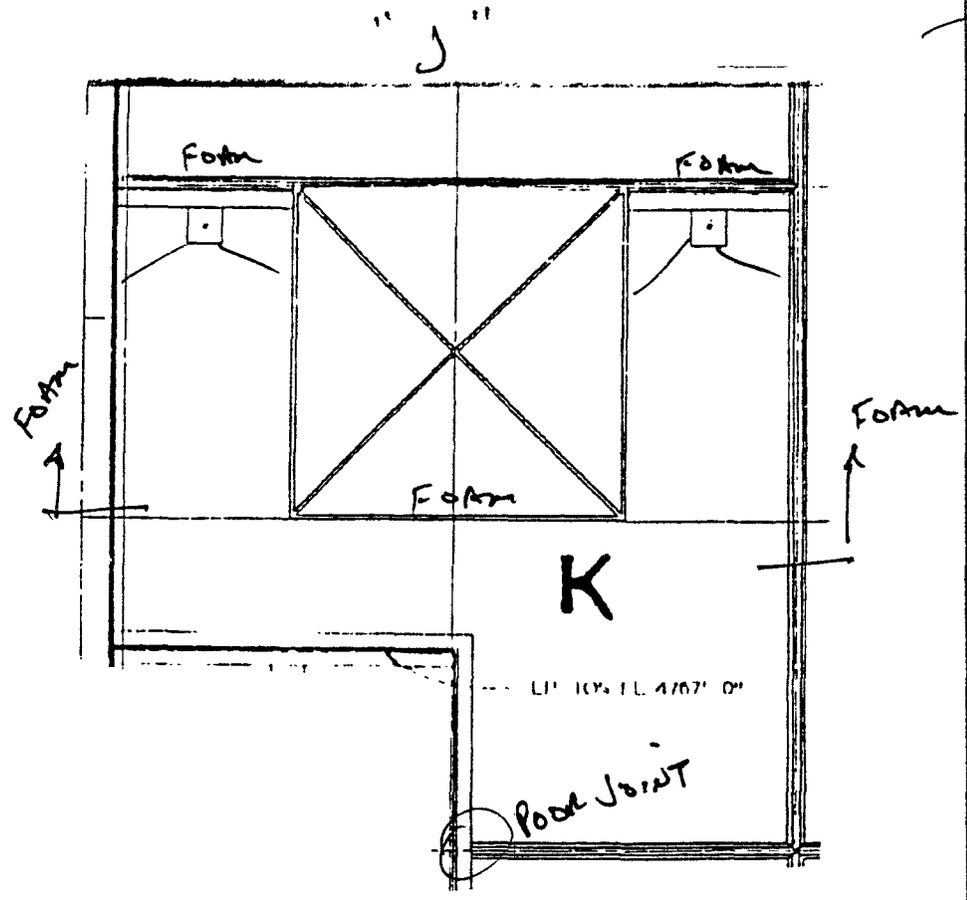
ROOF INSPECTION WORKSHEET	AGENCY/INST.:

BUILDING General Services PER. FLASHING 244 LF DATE _____

SECTION K CURB FLASHING 90 LF NAME _____

BF-BASE FLASH	PP-PITCH PANS	SP-SPLITS	PA-PATCHING
MC-METAL CAP	DR-DRAIN & SC	HL-HOLES	DV-DEBRIS & VEG
EM-EMBEDD MET	BL-BLISTERS	SR-SURF DET	EQ-EQ SUPPORT
FP-FLASHED PEN	RG-RIDGES	SL-SLIPPAGE	PD-PONDING

ID #	DIS	SEV	DEF	QTY
BF	2	L		244
BF	2	L		90
PA	3	M		2400
BF	2	L		334
BF	3	L		334
BF	2	M		344
PA	1	M		2400



No crickets

MCD Deter BF

SCALE: _____

NORTH

IP12_004342

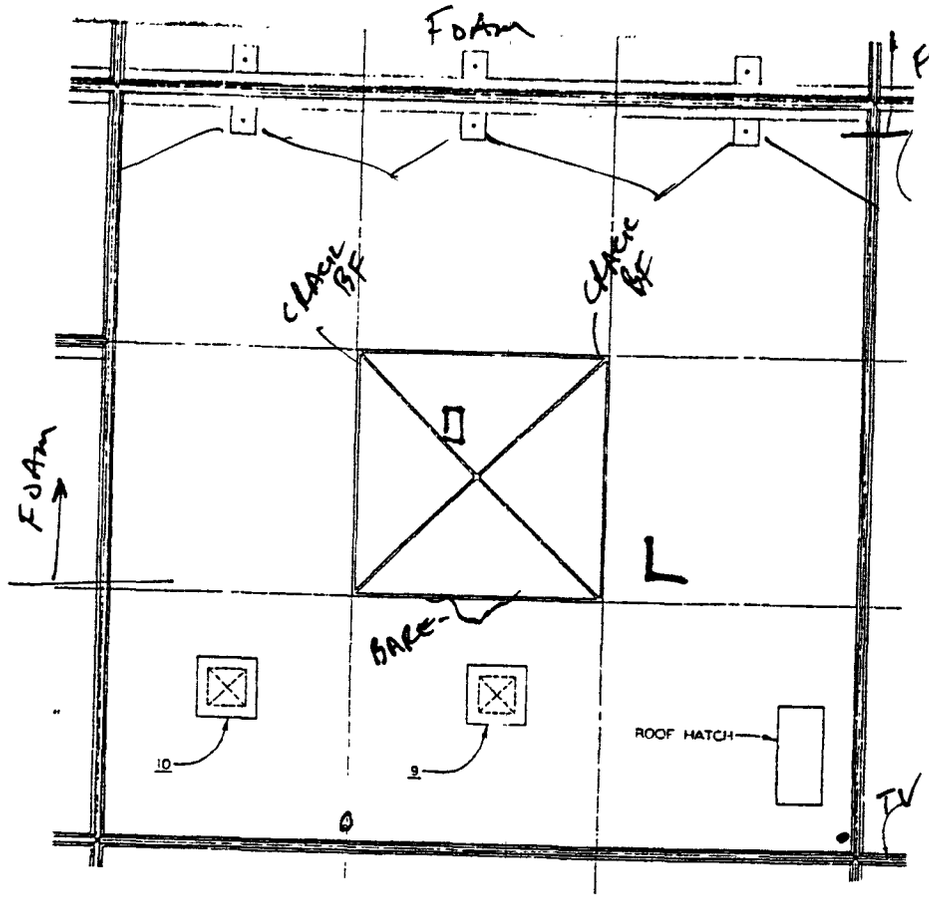
I P P

ROOF INSPECTION WORKSHEET	AGENCY/INST.:

BUILDING General Serv. PER. FLASHING 360 LF DATE _____

SECTION L CURB FLASHING 120 LF NAME _____

BF-BASE FLASH	PP-PITCH PANS	SP-SPLITS	PA-PATCHING
MC-METAL CAP	DR-DRAIN & SC	HL-HOLES	DV-DEBRIS & VEG
EM-EMBEDD MET	BL-BLISTERS	SR-SURF DET	EQ-EQ SUPPORT
FP-FLASHED PEN	RG-RIDGES	SL-SLIPPAGE	PD-PONDING



NO CLICKETS
MOD DETOR BF

ID #	DIS	SEV	DEF	QTY
BF	2	L		360
BF	2	L		~~120~~ 120
BF	13	H		2
PA	3	M		150
RD	2	M		3
SR	9	M		10
BF	2	L		480
BF	3	L		480
BF	2	M		480
BF	1	H		2
PA	1	M		150
DR	1	M		3
SR	1	M		10

SCALE: _____

↑ NORTH

IPP

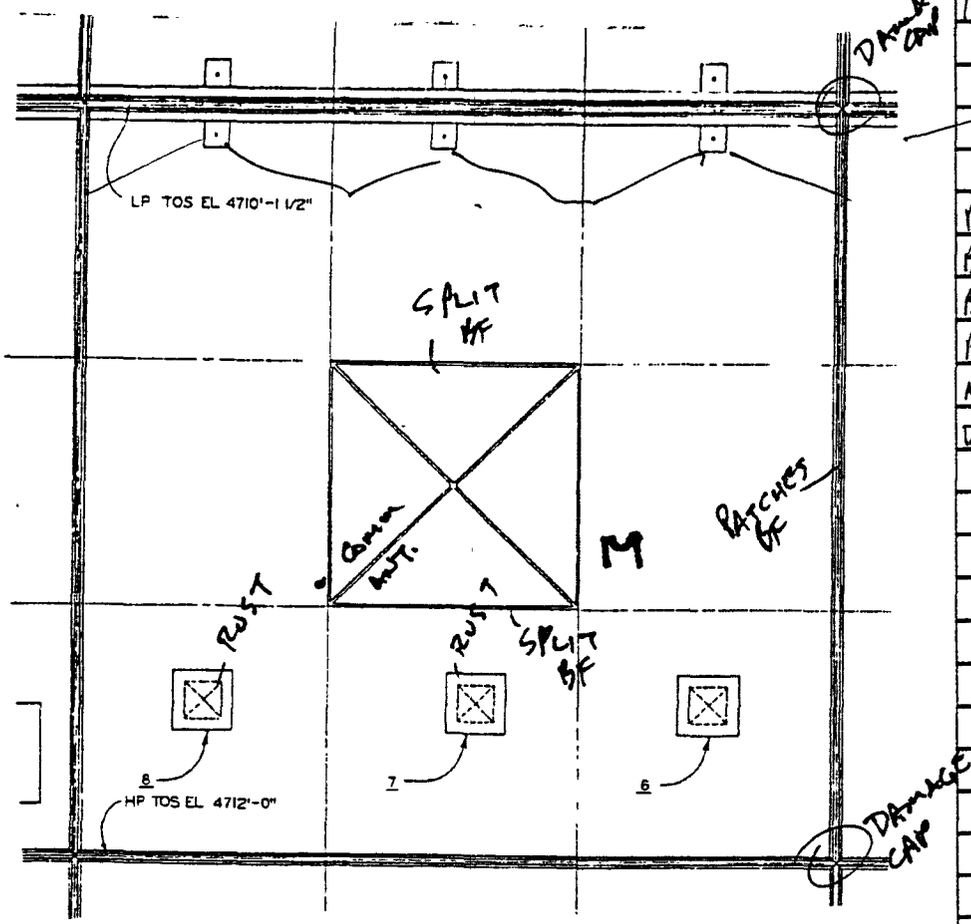
ROOF INSPECTION WORKSHEET	AGENCY/INST.:

BUILDING General Serv. PER. FLASHING 360 LF DATE _____

SECTION M CURB FLASHING ~~120~~ 168 LF NAME _____

BF-BASE FLASH	PP-PITCH PANS	SP-SPLITS	PA-PATCHING
MC-METAL CAP	DR-DRAIN & SC	HL-HOLES	DV-DEBRIS & VEG
EM-EMBEDD MET	BL-BLISTERS	SR-SURF DET	EQ-EQ SUPPORT
FP-FLASHED PEN	RG-RIDGES	SL-SLIPPAGE	PD-PONDING

ID #	DIS	SEV	DEF	QTY
BF	2	L		360
BF	2	L		~~120~~ 168
BF	13	H		2
MC	3	L		1
RD	2	M		3
BF	2	L		528
BF	3	L		528
BF	2	M		528
BF	1	H		2
MC	2	L		6
DR	1	M		3



NO CRICKETS
MOD DETERIOR BF

SCALE: _____

NORTH

IP12_004344

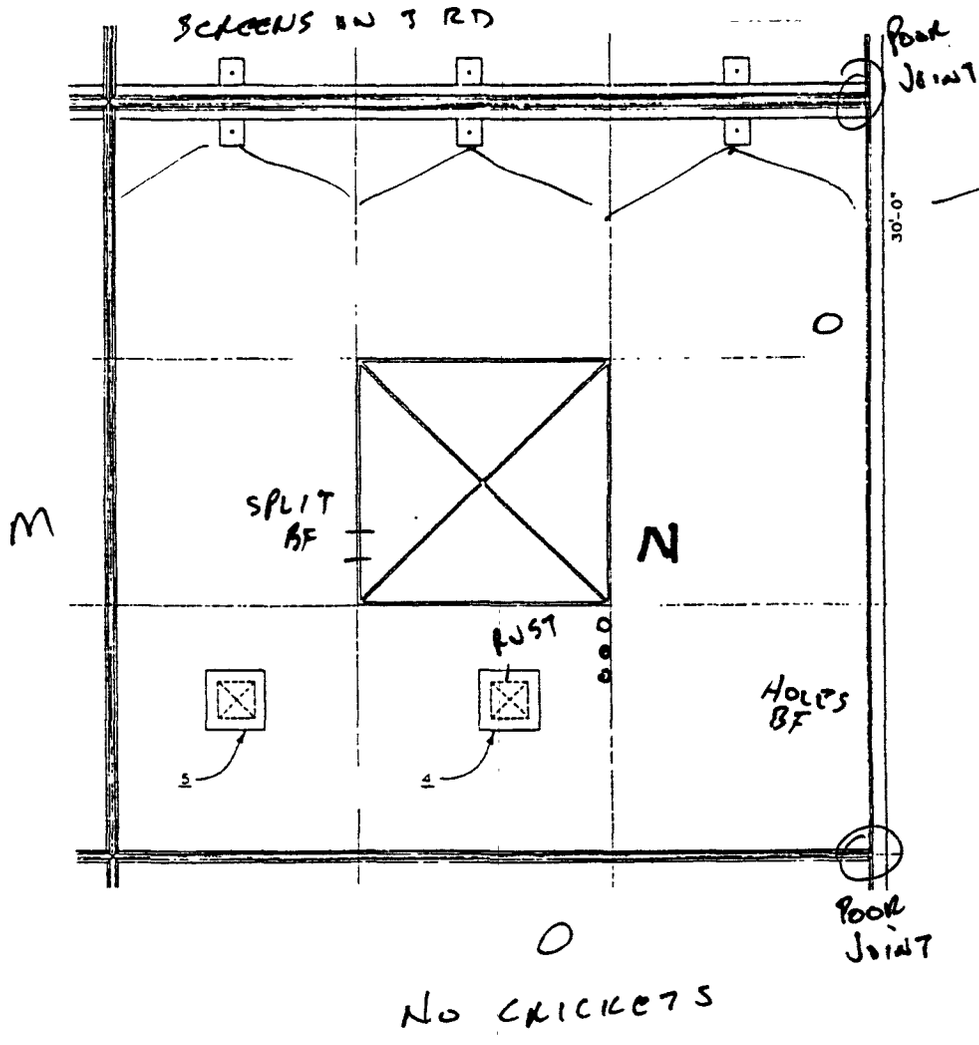
IPP

ROOF INSPECTION WORKSHEET	AGENCY/INST.:

BUILDING General Serv. PER. FLASHING 360 LF DATE _____

SECTION N CURB FLASHING 152 LF NAME _____

BF-BASE FLASH	PP-PITCH PANS	SP-SPLITS	PA-PATCHING
MC-METAL CAP	DR-DRAIN & SC	HL-HOLES	DV-DEBRIS & VEG
EM-EMBEDD MET	BL-BLISTERS	SR-SURF DET	EQ-EQ SUPPORT
FP-FLASHED PEN	RG-RIDGES	SL-SLIPPAGE	PD-PONDING



ID #	DIS	SEV	DEF	QTY
BF	2	L		360
BF	2	L		152
BF	13	H		2
BF	14	H		2
RD	2	M		3
PD	6	L		360
BF	2	L		512
BF	3	L		512
BF	2	M		512
BF	1	H		4
DR	1	M		3
PD	1	L		360

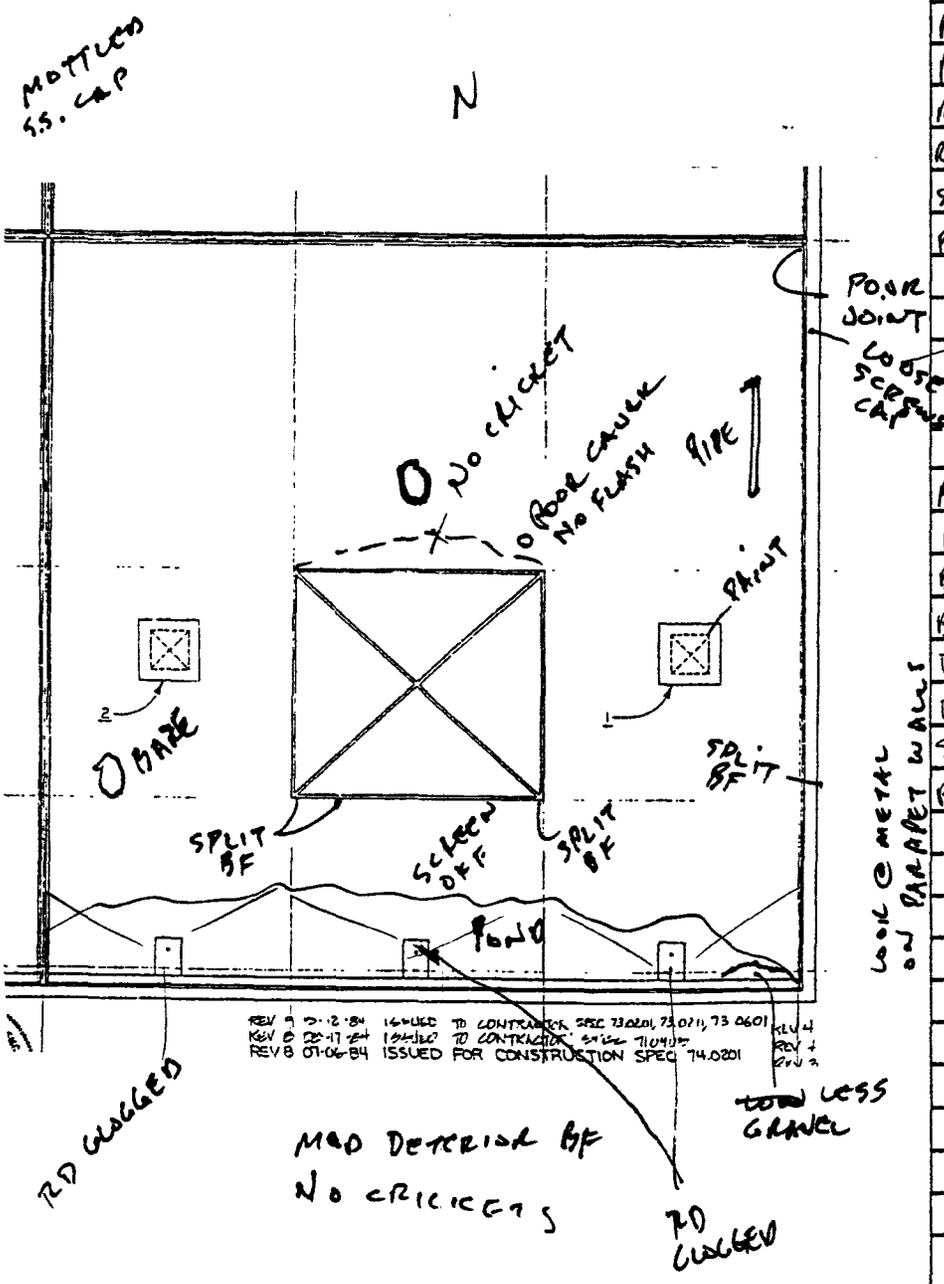
SCALE: _____

NORTH

IPP

ROOF INSPECTION WORKSHEET	AGENCY/INST.:
BUILDING General Serv. PER. FLASHING 360 LF	DATE
SECTION O CURB FLASHING 152 LF	NAME

BF-BASE FLASH	PP-PITCH PANS	SP-SPLITS	PA-PATCHING
MC-METAL CAP	DR-DRAIN & SC	HL-HOLES	DV-DEBRIS & VEG
EM-EMBEDD MET	BL-BLISTERS	SR-SURF DET	EQ-EQ SUPPORT
FP-FLASHED PEN	RG-RIDGES	SL-SLIPPAGE	PD-PONDING



SCALE: _____

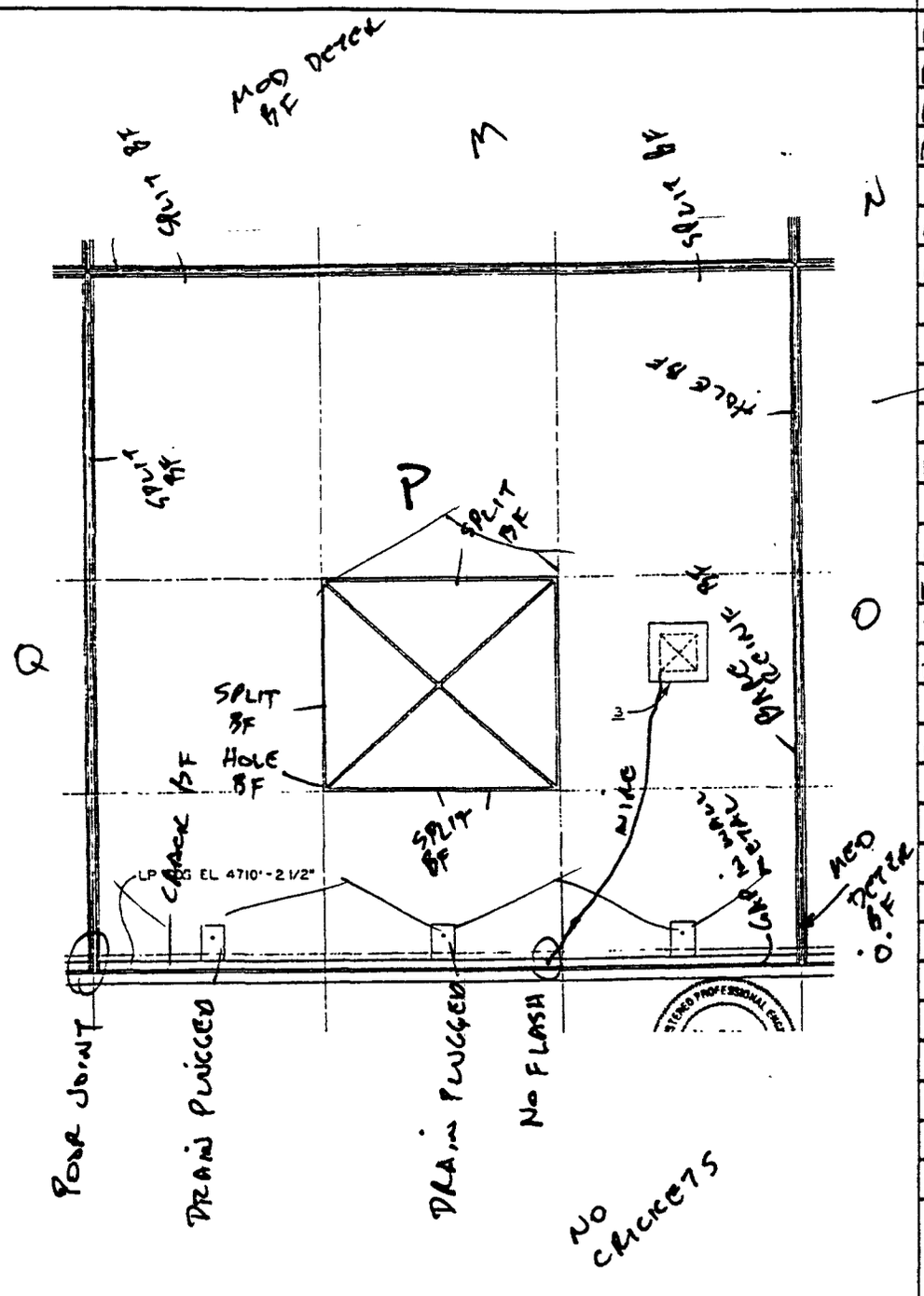
ID #	DIS	SEV	DEF	QTY
BF	2	L		360
BF	2	L		152
BF	13	H		4
RD	2	M		3
RD	6	H		3
SR	9	M		10
PD	6	L		540
BF	2	L		512
BF	3	L		512
BF	2	M		512
BF	1	H		4
DR	1	M		3
DR	3	H		3
SR	1	M		10
PD	1	L		540

NORTH

I P P

ROOF INSPECTION WORKSHEET	AGENCY/INST.:
BUILDING General Serv. PER. FLASHING 360 LF	DATE
SECTION P CURB FLASHING 106 LF	NAME

BF-BASE FLASH	PP-PITCH PANS	SP-SPLITS	PA-PATCHING
MC-METAL CAP	DR-DRAIN & SC	HL-HOLES	DV-DEBRIS & VEG
EM-EMBEDD MET	BL-BLISTERS	SR-SURF DET	EQ-EQ SUPPORT
FP-FLASHED PEN	RG-RIDGES	SL-SLIPPAGE	PD-PONDING



ID #	DIS	SEV	DEF	QTY
BF	2	L		360
BF	2	L		106
BF	13	H		7
BF	14	H		2
RD	2	M		3
RD	6	H		2
BF	12	H		2
BF	2	L		466
BF	3	L		466
BF	2	M		466
BF	1	H		9
DR	1	M		3
DR	3	H		2
BF	2	H		5
FP	3	H		1

NORTH

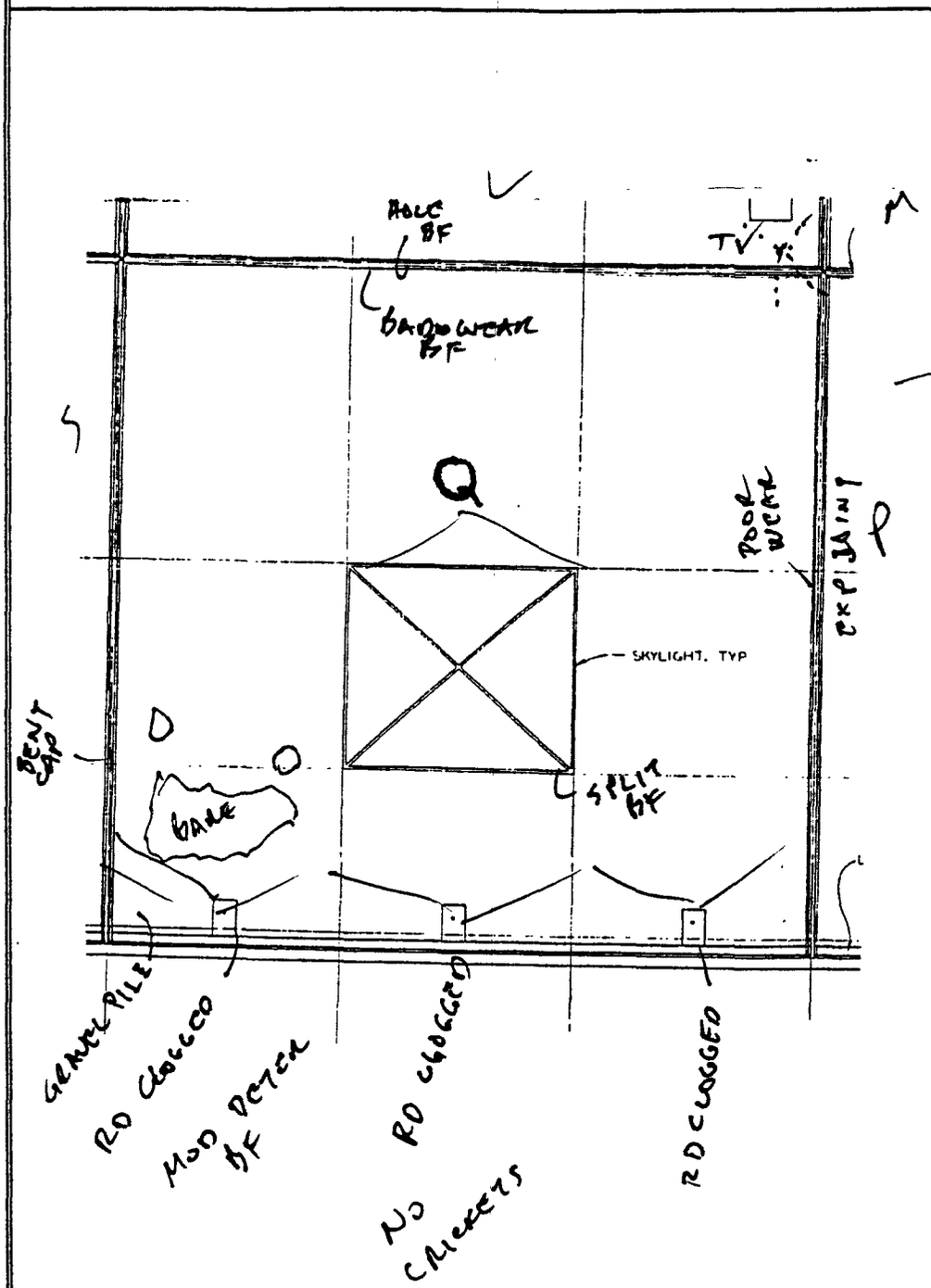
IPP

ROOF INSPECTION WORKSHEET	AGENCY/INST.:
BUILDING General Serv.	PER. FLASHING 360 LF
SECTION Q	CURB FLASHING 170 LF

DATE _____

NAME _____

BF-BASE FLASH	PP-PITCH PANS	SP-SPLITS	PA-PATCHING
MC-METAL CAP	DR-DRAIN & SC	HL-HOLES	DV-DEBRIS & VEG
EM-EMBEDD MET	BL-BLISTERS	SR-SURF DET	EQ-EQ SUPPORT
FP-FLASHED PEN	RG-RIDGES	SL-SLIPPAGE	PD-PONDING



ID #	DIS	SEV	DEF	QTY
BF	2	L		360
BF	2	L		90
BF	13	H		1
BF	14	H		1
SR	9	M		24
RD	2	M		3
RD	6	H		3
BF	2	L		480
BF	3	L		480
BF	2	M		480
BF	1	H		2
SR	1	M		24
DR	1	M		3
DR	3	H		3

SCALE: _____

NORTH

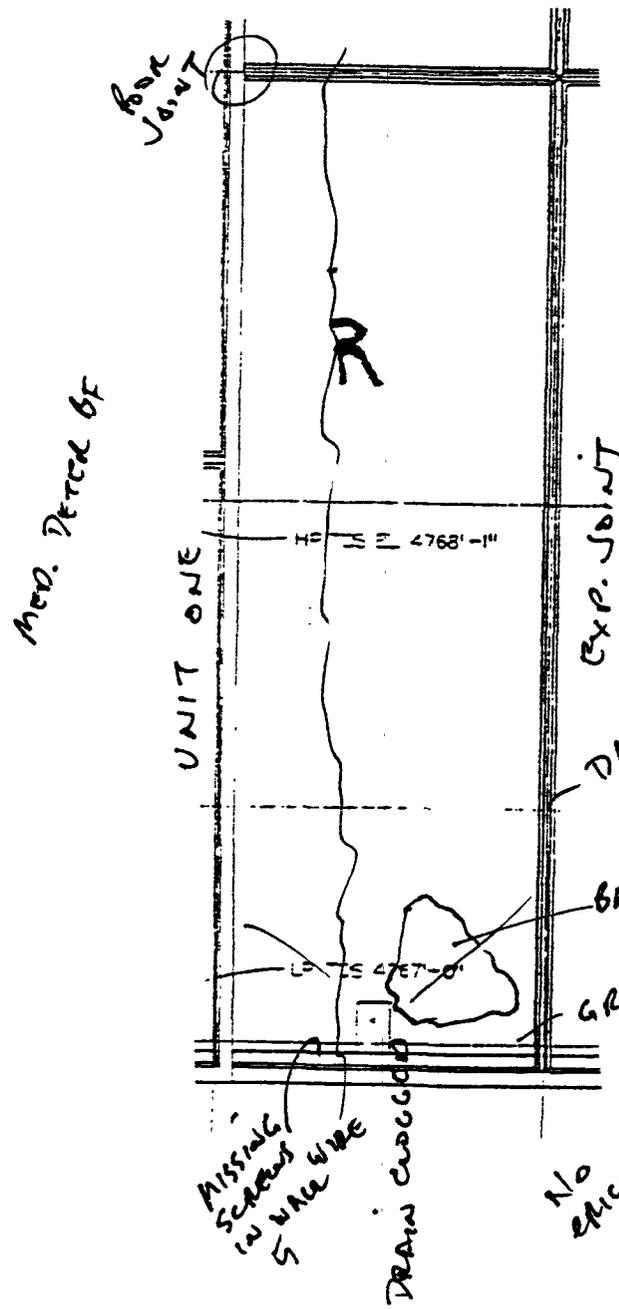
I 5 12

ROOF INSPECTION WORKSHEET	AGENCY/INST.:

BUILDING General Serv. PER. FLASHING 240 LF DATE _____

SECTION B CURB FLASHING _____ LF NAME _____

BF-BASE FLASH	PP-PITCH PANS	SP-SPLITS	PA-PATCHING
MC-METAL CAP	DR-DRAIN & SC	HL-HOLES	DV-DEBRIS & VEG
EM-EMBEDD MET	BL-BLISTERS	SR-SURF DET	EQ-EQ SUPPORT
FP-FLASHED PEN	RG-RIDGES	SL-SLIPPAGE	PD-PONDING



ID #	DIS	SEV	DEF	QTY
BF	2	L		240
SR	4	m		20
MC	3	L		1
RD	2	M		1
RD	6	H		1
BF	2	L		240
BF	3	L		240
BF	2	m		240
SR	1	m		20
MC	2	L		15
DR	1	m		1
DR	3	H		1

SCALE: _____

NORTH

VISUAL INSPECTION SUMMARY

The visual inspection gives unique information about each roof section. The area, perimeter and curb measurements are listed.

The summary also gives the Roof Condition Index (RCI). The RCI is calculated by combining the Flashing Condition Index (FCI), the Membrane Condition Index (MCI) and the Insulation Condition Index (ICI). During our inspection of the roofs, we found nearly all defects were with the base flashings and little, if any, visual defects in the membrane, such as blisters, splits, slipped asphalt plies or wind scour. The MCI, subsequently, is usually 100, meaning the membrane shows no defects. As mentioned earlier, the insulation was not evaluated and also shows an ICI of 100.

The RCI is a numeric score from one to one hundred, with anything under 60 requiring immediate evaluation and attention. The program estimates the cost of maintaining the roof each year for ten years and then makes an evaluation whether the roof should be maintained or replaced. An estimate is also made to the year when the roof should be replaced, based on the history of other similar roofs. The program only includes estimates for the coming ten years.

A list of the defects is included, with the severity and quantity. The FCI has the most typical defects. The membrane has few defects so the MCI is usually 100. Since the insulation was not examined, the ICI is always 100.

Brower & Associates
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fax (801) 225-0138

Date: JUL/13/2001	Visual Inspection Summary	Page 1

Installation: IPP - Intermountain Power Project

Date Inspected: 05/17/2001
Building: 9BSE-G - General Services
Section: 9BSEGA - General Services - A

Category Code: 21910 Maintenance and Production Facilities
Maintenance - Installation, Repair and Operation
Facilities Engineer Maintenance Shop

Roof Section Area: 5540 SqFt

Flashing Length: 320 Ft Perimeter: 152 Ft Curb: 168 Ft

FCI of Section: 41 Rating: Fair
MCI of Section: 88 Rating: Excellent
ICI of Section: None Rating: None

RCI of Section: 57 Rating: MODERATE REPAIRS NEEDED

Flashing Distresses

Distress Type		Severity	Quantity	Density	Deduct
BF	BASE FLASHING	H	1	0.31	5.9
BF	BASE FLASHING	M	320	100.00	50.3
BF	BASE FLASHING	L	488	152.50	19.9
DR	DRAIN & SCUPPER	H	2	0.63	36.5
DR	DRAIN & SCUPPER	M	3	0.94	17.0

Membrane Distresses

Distress Type		Severity	Quantity	Density	Deduct
DV	DEBRIS & VEG	M	20	0.36	2.1
PA	PATCHING	M	60	1.08	11.8

Date: JUL/13/2001	Visual Inspection Summary	Page 1

Installation: IPP - Intermountain Power Project

Date Inspected: 05/17/2001
Building: 9BSE-G - General Services
Section: 9BSEGB - General Services - B

Category Code: 21910 Maintenance and Production Facilities
Maintenance - Installation, Repair and Operation
Facilities Engineer Maintenance Shop

Roof Section Area: 8160 SqFt

Flashing Length: 504 Ft Perimeter: 376 Ft Curb: 128 Ft

FCI of Section: 50 Rating: Fair
MCI of Section: 87 Rating: Excellent
ICI of Section: None Rating: None

RCI of Section: 63 Rating: MODERATE REPAIRS NEEDED

Flashing Distresses

Distress Type		Severity	Quantity	Density	Deduct
BF	BASE FLASHING	H	15	2.98	15.2
BF	BASE FLASHING	M	504	100.00	50.3
BF	BASE FLASHING	L	631	125.20	19.6
DR	DRAIN & SCUPPER	M	2	0.40	10.3
MC	METAL CAP	M	15	2.98	10.3
PP	PITCH PAN	H	2	0.40	9.3

Membrane Distresses

Distress Type		Severity	Quantity	Density	Deduct
PD	PONDING	L	360	4.41	10.9
SR	SURFACE DET	M	16	0.20	6.7

Date: JUL/13/2001	Visual Inspection Summary	Page 1

Installation: IPP - Intermountain Power Project

Date Inspected: 05/17/2001
Building: 9BSE-G - General Services
Section: 9BSEGC - General Services - C

Category Code: 21910 Maintenance and Production Facilities
Maintenance - Installation, Repair and Operation
Facilities Engineer Maintenance Shop

Roof Section Area: 288 SqFt

Flashing Length: 96 Ft Perimeter: 96 Ft Curb: 0 Ft

FCI of Section: 50 Rating: Fair
MCI of Section: 100 Rating: Excellent
ICI of Section: None Rating: None

RCI of Section: 65 Rating: MODERATE REPAIRS NEEDED

Flashing Distresses

Distress Type		Severity	Quantity	Density	Deduct
BF	BASE FLASHING	M	96	100.00	50.3
BF	BASE FLASHING	L	95	98.96	19.1
DR	DRAIN & SCUPPER	M	2	2.08	17.5

Membrane Distresses

Distress Type	Severity	Quantity	Density	Deduct

None

Date: JUL/13/2001	Visual Inspection Summary	Page 1

Installation: IPP - Intermountain Power Project

Date Inspected: 05/17/2001
Building: 9BSE-G - General Services
Section: 9BSEGD - General Services - D

Category Code: 21910 Maintenance and Production Facilities
Maintenance - Installation, Repair and Operation
Facilities Engineer Maintenance Shop

Roof Section Area: 1800 SqFt

Flashing Length: 180 Ft Perimeter: 30 Ft Curb: 150 Ft

FCI of Section: 50 Rating: Fair
MCI of Section: 100 Rating: Excellent
ICI of Section: None Rating: None

RCI of Section: 65 Rating: MODERATE REPAIRS NEEDED

Flashing Distresses

Distress Type		Severity	Quantity	Density	Deduct
BF	BASE FLASHING	M	180	100.00	50.3
BF	BASE FLASHING	L	330	183.33	20.1
DR	DRAIN & SCUPPER	M	1	0.56	12.9
MC	METAL CAP	M	12	6.67	13.1

Membrane Distresses

Distress Type	Severity	Quantity	Density	Deduct

None

Date: JUL/13/2001	Visual Inspection Summary	Page 1

Installation: IPP - Intermountain Power Project

Date Inspected: 05/17/2001
Building: 9BSE-G - General Services
Section: 9BSEGE - General Services - E

Category Code: 21910 Maintenance and Production Facilities
Maintenance - Installation, Repair and Operation
Facilities Engineer Maintenance Shop

Roof Section Area: 5540 SqFt

Flashing Length: 304 Ft Perimeter: 152 Ft Curb: 152 Ft

FCI of Section: 44 Rating: Fair
MCI of Section: 85 Rating: Very Good
ICI of Section: None Rating: None

RCI of Section: 59 Rating: MODERATE REPAIRS NEEDED

Flashing Distresses

Distress Type		Severity	Quantity	Density	Deduct
BF	BASE FLASHING	M	304	100.00	50.3
BF	BASE FLASHING	L	456	150.00	19.8
DR	DRAIN & SCUPPER	H	1	0.33	29.3
DR	DRAIN & SCUPPER	M	3	0.99	17.4
MC	METAL CAP	M	12	3.95	11.2

Membrane Distresses

Distress Type		Severity	Quantity	Density	Deduct
PD	PONDING	L	368	6.64	14.6

Date: JUL/13/2001	Visual Inspection Summary	Page 1

Installation: IPP - Intermountain Power Project

Date Inspected: 05/17/2001
Building: 9BSE-G - General Services
Section: 9BSEGF - General Services - F

Category Code: 21910 Maintenance and Production Facilities
Maintenance - Installation, Repair and Operation
Facilities Engineer Maintenance Shop

Roof Section Area: 3740 SqFt

Flashing Length: 350 Ft Perimeter: 244 Ft Curb: 106 Ft

FCI of Section: 50 Rating: Fair
MCI of Section: 29 Rating: Poor
ICI of Section: None Rating: None

RCI of Section: 43 Rating: MAJOR REPAIRS NEEDED

Flashing Distresses

Distress Type		Severity	Quantity	Density	Deduct
BF	BASE FLASHING	M	350	100.00	50.3
BF	BASE FLASHING	L	456	130.29	19.6

Membrane Distresses

Distress Type		Severity	Quantity	Density	Deduct
PA	PATCHING	M	3700	98.93	70.9

Installation: IPP - Intermountain Power Project

Date Inspected: 05/17/2001
Building: 9BSE-G - General Services
Section: 9BSEGG - General Services - G

Category Code: 21910 Maintenance and Production Facilities
Maintenance - Installation, Repair and Operation
Facilities Engineer Maintenance Shop

Roof Section Area: 4920 SqFt

Flashing Length: 348 Ft Perimeter: 300 Ft Curb: 48 Ft

FCI of Section: 50 Rating: Fair
MCI of Section: 78 Rating: Very Good
ICI of Section: None Rating: None

RCI of Section: 62 Rating: MODERATE REPAIRS NEEDED

Flashing Distresses

Distress Type		Severity	Quantity	Density	Deduct
BF	BASE FLASHING	H	1	0.29	5.8
BF	BASE FLASHING	M	348	100.00	50.3
BF	BASE FLASHING	L	396	113.79	19.4

Membrane Distresses

Distress Type		Severity	Quantity	Density	Deduct
PA	PATCHING	M	248	5.04	21.9

Date: JUL/13/2001	Visual Inspection Summary	Page 1

Installation: IPP - Intermountain Power Project

Date Inspected: 05/17/2001
Building: 9BSE-G - General Services
Section: 9BSEGH - General Services - H

Category Code: 21910 Maintenance and Production Facilities
Maintenance - Installation, Repair and Operation
Facilities Engineer Maintenance Shop

Roof Section Area: 4920 SqFt

Flashing Length: 448 Ft Perimeter: 400 Ft Curb: 48 Ft

FCI of Section: 50 Rating: Fair
MCI of Section: 81 Rating: Very Good
ICI of Section: None Rating: None

RCI of Section: 62 Rating: MODERATE REPAIRS NEEDED

Flashing Distresses

Distress Type		Severity	Quantity	Density	Deduct
BF	BASE FLASHING	M	448	100.00	50.3
BF	BASE FLASHING	L	496	110.71	19.3
DR	DRAIN & SCUPPER	M	3	0.67	14.4
MC	METAL CAP	M	6	1.34	7.7

Membrane Distresses

Distress Type		Severity	Quantity	Density	Deduct
PA	PATCHING	M	40	0.81	10.6
PD	PONDING	L	360	7.32	15.6

Installation: IPP - Intermountain Power Project

Date Inspected: 05/17/2001
Building: 9BSE-G - General Services
Section: 9BSEGI - General Services - I

Category Code: 21910 Maintenance and Production Facilities
Maintenance - Installation, Repair and Operation
Facilities Engineer Maintenance Shop

Roof Section Area: 5400 SqFt

Flashing Length: 522 Ft Perimeter: 400 Ft Curb: 122 Ft

FCI of Section: 50 Rating: Fair
MCI of Section: 85 Rating: Very Good
ICI of Section: None Rating: None

RCI of Section: 63 Rating: MODERATE REPAIRS NEEDED

Flashing Distresses

Distress Type		Severity	Quantity	Density	Deduct
BF	BASE FLASHING	H	3	0.57	7.0
BF	BASE FLASHING	M	522	100.00	50.3
BF	BASE FLASHING	L	644	123.37	19.5
DR	DRAIN & SCUPPER	M	3	0.57	13.2
MC	METAL CAP	M	6	1.15	7.2

Membrane Distresses

Distress Type		Severity	Quantity	Density	Deduct
PD	PONDING	L	360	6.67	14.6

Installation: IPP - Intermountain Power Project

Date Inspected: 05/17/2001
Building: 9BSE-G - General Services
Section: 9BSEGJ - General Services - J

Category Code: 21910 Maintenance and Production Facilities
Maintenance - Installation, Repair and Operation
Facilities Engineer Maintenance Shop

Roof Section Area: 1870 SqFt

Flashing Length: 184 Ft Perimeter: 184 Ft Curb: 0 Ft

FCI of Section: 50 Rating: Fair
MCI of Section: 82 Rating: Very Good
ICI of Section: None Rating: None

RCI of Section: 62 Rating: MODERATE REPAIRS NEEDED

Flashing Distresses

Distress Type		Severity	Quantity	Density	Deduct
BF	BASE FLASHING	M	184	100.00	50.3
BF	BASE FLASHING	L	184	100.00	19.1
DR	DRAIN & SCUPPER	M	2	1.09	17.5

Membrane Distresses

Distress Type		Severity	Quantity	Density	Deduct
PA	PATCHING	M	60	3.21	18.1

Installation: IPP - Intermountain Power Project

Date Inspected: 05/17/2001
Building: 9BSE-G - General Services
Section: 9BSEGK - General Services - K

Category Code: 21910 Maintenance and Production Facilities
Maintenance - Installation, Repair and Operation
Facilities Engineer Maintenance Shop

Roof Section Area: 3158 SqFt

Flashing Length: 334 Ft Perimeter: 244 Ft Curb: 90 Ft

FCI of Section: 50 Rating: Fair
MCI of Section: 36 Rating: Poor
ICI of Section: None Rating: None

RCI of Section: 48 Rating: MAJOR REPAIRS NEEDED

Flashing Distresses

Distress Type		Severity	Quantity	Density	Deduct
BF	BASE FLASHING	M	334	100.00	50.3
BF	BASE FLASHING	L	424	126.95	19.6
MC	METAL CAP	M	6	1.80	8.6

Membrane Distresses

Distress Type		Severity	Quantity	Density	Deduct
PA	PATCHING	M	2400	76.00	64.5

Date: JUL/13/2001	Visual Inspection Summary	Page 1

Installation: IPP - Intermountain Power Project

Date Inspected: 05/17/2001
Building: 9BSE-G - General Services
Section: 9BSEGL - General Services - L

Category Code: 21910 Maintenance and Production Facilities
Maintenance - Installation, Repair and Operation
Facilities Engineer Maintenance Shop

Roof Section Area: 8100 SqFt

Flashing Length: 535 Ft Perimeter: 360 Ft Curb: 175 Ft

FCI of Section: 50 Rating: Fair
MCI of Section: 86 Rating: Excellent
ICI of Section: None Rating: None

RCI of Section: 63 Rating: MODERATE REPAIRS NEEDED

Flashing Distresses

Distress Type		Severity	Quantity	Density	Deduct
BF	BASE FLASHING	H	2	0.37	6.2
BF	BASE FLASHING	M	535	100.00	50.3
BF	BASE FLASHING	L	709	132.52	19.7
DR	DRAIN & SCUPPER	M	3	0.56	13.0

Membrane Distresses

Distress Type		Severity	Quantity	Density	Deduct
PA	PATCHING	M	150	1.85	14.5
SR	SURFACE DET	M	10	0.12	5.3

Installation: IPP - Intermountain Power Project

Date Inspected: 05/17/2001
Building: 9BSE-G - General Services
Section: 9BSEGM - General Services - M

Category Code: 21910 Maintenance and Production Facilities
Maintenance - Installation, Repair and Operation
Facilities Engineer Maintenance Shop

Roof Section Area: 8100 SqFt

Flashing Length: 528 Ft Perimeter: 360 Ft Curb: 168 Ft

FCI of Section: 50 Rating: Fair
MCI of Section: 100 Rating: Excellent
ICI of Section: None Rating: None

RCI of Section: 65 Rating: MODERATE REPAIRS NEEDED

Flashing Distresses

Distress Type		Severity	Quantity	Density	Deduct
BF	BASE FLASHING	H	2	0.38	6.2
BF	BASE FLASHING	M	528	100.00	50.3
BF	BASE FLASHING	L	696	131.82	19.7
DR	DRAIN & SCUPPER	M	3	0.57	13.1
MC	METAL CAP	L	12	2.27	4.2

Membrane Distresses

Distress Type	Severity	Quantity	Density	Deduct
None				

Date: JUL/13/2001	Visual Inspection Summary	Page 1

Installation: IPP - Intermountain Power Project

Date Inspected: 05/17/2001
Building: 9BSE-G - General Services
Section: 9BSEGN - General Services - N

Category Code: 21910 Maintenance and Production Facilities
Maintenance - Installation, Repair and Operation
Facilities Engineer Maintenance Shop

Roof Section Area: 8100 SqFt

Flashing Length: 512 Ft Perimeter: 360 Ft Curb: 152 Ft

FCI of Section: 50 Rating: Fair
MCI of Section: 89 Rating: Excellent
ICI of Section: None Rating: None

RCI of Section: 63 Rating: MODERATE REPAIRS NEEDED

Flashing Distresses

Distress Type		Severity	Quantity	Density	Deduct
BF	BASE FLASHING	H	3	0.59	7.0
BF	BASE FLASHING	M	512	100.00	50.3
BF	BASE FLASHING	L	664	129.69	19.6
DR	DRAIN & SCUPPER	M	3	0.59	13.4
MC	METAL CAP	M	6	1.17	7.3

Membrane Distresses

Distress Type		Severity	Quantity	Density	Deduct
PD	PONDING	L	360	4.44	10.9

Date: JUL/13/2001	Visual Inspection Summary	Page 1

Installation: IPP - Intermountain Power Project

Date Inspected: 05/17/2001
Building: 9BSE-G - General Services
Section: 9BSEGO - General Services - O

Category Code: 21910 Maintenance and Production Facilities
Maintenance - Installation, Repair and Operation
Facilities Engineer Maintenance Shop

Roof Section Area: 8156 SqFt

Flashing Length: 512 Ft Perimeter: 360 Ft Curb: 152 Ft

FCI of Section: 43 Rating: Fair
MCI of Section: 86 Rating: Excellent
ICI of Section: None Rating: None

RCI of Section: 58 Rating: MODERATE REPAIRS NEEDED

Flashing Distresses

Distress Type		Severity	Quantity	Density	Deduct
BF	BASE FLASHING	H	4	0.78	7.8
BF	BASE FLASHING	M	512	100.00	50.3
BF	BASE FLASHING	L	664	129.69	19.6
DR	DRAIN & SCUPPER	H	3	0.59	35.9
DR	DRAIN & SCUPPER	M	2	0.39	10.2
MC	METAL CAP	M	12	2.34	9.5

Membrane Distresses

Distress Type		Severity	Quantity	Density	Deduct
PD	PONDING	L	540	6.62	14.5
SR	SURFACE DET	M	10	0.12	5.3

Date: JUL/13/2001	Visual Inspection Summary	Page 1

Installation: IPP - Intermountain Power Project

Date Inspected: 05/17/2001
Building: 9BSE-G - General Services
Section: 9BSEGP - General Services - P

Category Code: 21910 Maintenance and Production Facilities
Maintenance - Installation, Repair and Operation
Facilities Engineer Maintenance Shop

Roof Section Area: 7950 SqFt

Flashing Length: 466 Ft Perimeter: 360 Ft Curb: 106 Ft

FCI of Section: 44 Rating: Fair
MCI of Section: 100 Rating: Excellent
ICI of Section: None Rating: None

RCI of Section: 61 Rating: MODERATE REPAIRS NEEDED

Flashing Distresses

Distress Type		Severity	Quantity	Density	Deduct
BF	BASE FLASHING	H	9	1.93	12.0
BF	BASE FLASHING	M	466	100.00	50.3
BF	BASE FLASHING	L	572	122.75	19.5
DR	DRAIN & SCUPPER	H	2	0.43	32.5
DR	DRAIN & SCUPPER	M	3	0.64	14.1
FP	FLASHED PEN	H	1	0.21	10.4
MC	METAL CAP	M	12	2.58	9.8

Membrane Distresses

Distress Type	Severity	Quantity	Density	Deduct
None				

Date: JUL/13/2001	Visual Inspection Summary	Page 1

Installation: IPP - Intermountain Power Project

Date Inspected: 05/17/2001
Building: 9BSE-G - General Services
Section: 9BSEGQ - General Services - Q

Category Code: 21910 Maintenance and Production Facilities
Maintenance - Installation, Repair and Operation
Facilities Engineer Maintenance Shop

Roof Section Area: 7950 SqFt

Flashing Length: 480 Ft Perimeter: 360 Ft Curb: 120 Ft

FCI of Section: 42 Rating: Fair
MCI of Section: 92 Rating: Excellent
ICI of Section: None Rating: None

RCI of Section: 58 Rating: MODERATE REPAIRS NEEDED

Flashing Distresses

Distress Type		Severity	Quantity	Density	Deduct
BF	BASE FLASHING	H	2	0.42	6.3
BF	BASE FLASHING	M	480	100.00	50.3
BF	BASE FLASHING	L	600	125.00	19.6
DR	DRAIN & SCUPPER	H	3	0.63	36.5
DR	DRAIN & SCUPPER	M	3	0.63	13.9
MC	METAL CAP	L	6	1.25	3.0

Membrane Distresses

Distress Type		Severity	Quantity	Density	Deduct
SR	SURFACE DET	M	24	0.30	7.9

Date: JUL/13/2001	Visual Inspection Summary	Page 1

Installation: IPP - Intermountain Power Project

Date Inspected: 05/17/2001
Building: 9BSE-G - General Services
Section: 9BSEGR - General Services - R

Category Code: 21910 Maintenance and Production Facilities
Maintenance - Installation, Repair and Operation
Facilities Engineer Maintenance Shop

Roof Section Area: 2650 SqFt

Flashing Length: 240 Ft Perimeter: 240 Ft Curb: 0 Ft

FCI of Section: 45 Rating: Fair
MCI of Section: 90 Rating: Excellent
ICI of Section: None Rating: None

RCI of Section: 60 Rating: MODERATE REPAIRS NEEDED

Flashing Distresses

Distress Type		Severity	Quantity	Density	Deduct
BF	BASE FLASHING	M	240	100.00	50.3
BF	BASE FLASHING	L	240	100.00	19.1
DR	DRAIN & SCUPPER	H	1	0.42	32.2
DR	DRAIN & SCUPPER	M	1	0.42	10.7
MC	METAL CAP	M	5	2.08	9.1
MC	METAL CAP	L	6	2.50	4.4

Membrane Distresses

Distress Type		Severity	Quantity	Density	Deduct
SR	SURFACE DET	M	20	0.75	10.3

Maintenance, Repair & Replacement Analysis

With the roof drawings and the defect list, a workman can easily find the defect and correct it. The Owner also has a guide to the normal cost of the repairs.

The MR&R gives more information about the roof section, such as area and current age.

The program predicts a year for probable replacement without any repairs and another date if the suggested repairs are made.

The cost of repairs is estimated, along with the cost for replacement. The cost of repairs is compared to the cost of replacement and a recommendation is given: repair, marginal or replace. The user must consider that the recommendation is only for the particular section of the roof being reported. The overall condition of the entire roof should be evaluated before making a final decision.

The second page justifies the recommendation made. It also included design considerations that should be considered when the work is designed.

The last sheet lists the recommended corrective action for maintenance or repairs.

With the enclosed information, the Owner can sit down with the roof consultant to create a plan for roof repairs and replacements for the next ten years. An inspection schedule can be made and a structured plan formalized to assure that the roofs receive proper attention.

Brower & Associates
Architects & Planners

1776 North State Street - Suite 300
Orem, Utah 84057-2025

(801) 225-8859
fax (801) 225-0138

Maintenance, Repair & Replacement Analysis

Building: 9BSE-G - General Services
Section: 9BSEGA
Section Area: 5540

Area Cost Index: $1.00
Roof Replacement Cost: $5.25 per SF
Insulation Replacement Cost: $8.00 per SF

Originally Constructed/Last Replaced: 1985
Current Age: 16 Year(s)

Visual Inspection Date: 5/17/2001
Insulation Inspection Date: --------

Predicted Year of Replacement (w/o repairs): 2005
Additional Service Life (w/repairs): 7 Year(s)
Predicted Year of Replacement (w/repairs): 2012

					Current	Improved
				ICI	100	100
				FCI	41	80
Cost for Repairs:	$ 3135.00	447.86	$/year	MCI	88	100
Cost for Replacement:	$ 29085.00	1454.00	$/year	RCI	57	86

Adjusted Repair/Replace Ratio = 0.47

Recommendation: Repair

IP12_004370

Generated: Jul/16/2001

Corrective Action Requirement Sheet

Major Repair

(Note: Attach a copy of this form, along with a copy of the Roof Inspection Worksheet to DA Form 4283

Agency/Inst.:	IPP - Intermountain Power Project	Facility No:	S1430
Bldg No./Sec:	9BSE-G 9BSEGA	Bldg Name:	General Services
Bldg Use:	Maintenance	Inspection Date:	May/2001
Membrane:	BUR: Asphalt	Area (SF):	5540
Surfacing:	AGG: Pea Gravel	Age (Yrs):	16
Vapor Ret:	UNKNOWN	Deck Type:	STEEL
Insulation:	EXPANDED POLYSTYRENE	Est. Repair Cost:	$ 3135.00

CORRECTIVE ACTION RECOMMENDED: Maintenance, Repair and/or Partial Replacement

JUSTIFICATION: An economic analysis of the roof condition, including age, indicates that it is more cost effective to accomplish the necessary maintenance, repairs and/or partial replacement of the roofing components rather than replace the roofing system. Therefore, accomplish the following actions for the above roof section.

[Note: numbers refer to identification numbers of distresses corresponding with the Roof Inspection Worksheet]

3.	BF-M-2 320 LF	Prime exposed and deteriorated base flashing and coat with heavy bodied asphalt coating. [3]
4.	BF-H-2 1 LF	Install extension of counterflashing over exposed top termination of base flashing. Three course open side laps in base flashing. [4]
5.	PA-M-1 60 SF	Replace patches having inferior repair material with same or better quality than existing membrane. Restore surfacing material. [5]
6.	DR-M-1 3	Prime and coat surface of roof drains having exposed stripping felts with heavy bodied asphalt coating. [6]
7.	DR-H-3 2	Remove foreign material clogging roof drains. [7]
8.	DV-M-1 20 SF	Remove foreign objects from roof. [8]

Economic Evaluation Worksheet for a Built-Up Roofing System

Agency/Inst: IPP - Intermountain Power Project | Building/Section: 9BSE-G 9BSEGA | Area: 5540 SF | Age: 16

Flashing

DIS-SL-DF	Unit Cost	Qty	Total Cost
BF-H-1	23.37		
BF-H-2	9.97	1	$ 9.97
BF-H-3	30.69		
BF-M-1	4.72		
BF-M-2	4.78	320	$ 1529.60
BF-M-3	5.88		
BF-M-4	19.03		
DR-H-1	27.51		
DR-H-2	51.45		
DR-H-3	47.43	2	$ 94.86
DR-H-4	102.21		
DR-M-1	21.98	3	$ 65.94
DR-M-2	34.20		
DR-M-3	19.54		
EM-H-1	6.63		
EM-H-2	8.56		
EM-H-3	14.60		
EM-H-4	7.63		
EM-H-5	21.16		
EM-M-2	6.46		
EM-M-3	6.68		
EM-M-4	6.80		
FP-H-1	16.82		
FP-H-2	47.26		
FP-H-3	82.84		
FP-H-4	22.88		
FP-M-1	4.81		
FP-M-2	5.78		
FP-M-3	31.07		
FP-M-4	19.54		
MC-H-1	9.50		
MC-H-2	9.44		
MC-H-3	5.37		
MC-M-1	15.41		
MC-M-2	18.19		
MC-M-3	8.11		
MC-M-4	4.00		
MC-M-5	6.63		
PP-H-1	19.54		
PP-H-2	37.47		
PP-H-3	21.98		
PP-H-4	51.69		

DIS-SL-DF	Unit Cost	Qty	Total Cost

Insulation: 0.00 NONE

Repair SetUp Charge = $ 514

IP12_004372

Maintenance, Repair & Replacement Analysis

Building:	9BSE-G - General Services	Area Cost Index:	$1.00
Section:	9BSEGB	Roof Replacement Cost:	$5.25 per SF
Section Area:	8160	Insulation Replacement Cost:	$8.00 per SF

Originally Constructed/Last Replaced:	1985	Visual Inspection Date:	5/17/2001
Current Age:	16 Year(s)	Insulation Inspection Date:	--------

Predicted Year of Replacement (w/o repairs):			2006				
Additional Service Life (w/repairs):			5	Year(s)		Current	Improved
Predicted Year of Replacement (w/repairs):			2011		ICI	100	100
					FCI	50	80
Cost for Repairs:	$	3538.00	707.60	$/year	MCI	87	89
Cost for Replacement:	$	42840.00	2142.00	$/year	RCI	63	84

Adjusted Repair/Replace Ratio = 0.49 Recommendation: Repair

IP12_004373

Generated: Jul/13/2001

Corrective Action Requirement Sheet

Major Repair

(Note: Attach a copy of this form, along with a copy of the Roof Inspection Worksheet to DA Form 4283

Agency/Inst.:	IPP - Intermountain Power Project	Facility No:	S1430
Bldg No./Sec:	9BSE-G 9BSEGB	Bldg Name:	General Services
Bldg Use:	Maintenance	Inspection Date:	May/2001
Membrane:	BUR: Asphalt	Area (SF):	8160
Surfacing:	AGG: Pea Gravel	Age (Yrs):	16
Vapor Ret:	UNKNOWN	Deck Type:	STEEL
Insulation:	EXPANDED POLYSTYRENE	Est. Repair Cost:	$ 3538.00

CORRECTIVE ACTION RECOMMENDED: Maintenance, Repair and/or Partial Replacement

JUSTIFICATION: An economic analysis of the roof condition, including age, indicates that it is more cost effective to accomplish the necessary maintenance, repairs and/or partial replacement of the roofing components rather than replace the roofing system. Therefore, accomplish the following actions for the above roof section.

[Note: numbers refer to identification numbers of distresses corresponding with the Roof Inspection Worksheet]

3.	BF-M-2 504 LF	Prime exposed and deteriorated base flashing and coat with heavy bodied asphalt coating. [3]
4.	BF-H-1 3 LF	Repair damaged base flashing by overlaying each localized defect with new base flashing. [4]
5.	BF-H-2 12 LF	Install extension of counterflashing over exposed top termination of base flashing. Three course open side laps in base flashing. [5]
7.	PP-H-2 2	Fill pitch pans with sealant and crown to assure moisture runoff. [7]
8.	SR-M-1 16 SF	Reinstall aggregate on exposed membrane surfaces. [8]
9.	DR-M-1 2	Prime and coat surface of roof drains having exposed stripping felts with heavy bodied asphalt coating. [9]
10.	MC-M-2 15 LF	Reseal failed joints in metal coping cap and reattach. [10]

Economic Evaluation Worksheet for a Built-Up Roofing System

Agency/Inst: IPP - Intermountain Power Project | Building/Section: 9BSE-G 9BSEGB | Area: 8160 SF | Age: 16

Flashing

DIS-SL-DF	Unit Cost	Qty	Total Cost
BF-H-1	23.37	3	$ 70.11
BF-H-2	9.97	12	$ 119.64
BF-H-3	30.69		
BF-M-1	4.72		
BF-M-2	4.78	504	$ 2409.12
BF-M-3	5.88		
BF-M-4	19.03		
DR-H-1	27.51		
DR-H-2	51.45		
DR-H-3	47.43		
DR-H-4	102.21		
DR-M-1	21.98	2	$ 43.96
DR-M-2	34.20		
DR-M-3	19.54		
EM-H-1	6.63		
EM-H-2	8.56		
EM-H-3	14.60		
EM-H-4	7.63		
EM-H-5	21.16		
EM-M-2	6.46		
EM-M-3	6.68		
EM-M-4	6.80		
FP-H-1	16.82		
FP-H-2	47.26		
FP-H-3	82.84		
FP-H-4	22.88		
FP-M-1	4.81		
FP-M-2	5.78		
FP-M-3	31.07		
FP-M-4	19.54		
MC-H-1	9.50		
MC-H-2	9.44		
MC-H-3	5.37		
MC-M-1	15.41		
MC-M-2	18.19	15	$ 272.85
MC-M-3	8.11		
MC-M-4	4.00		
MC-M-5	6.63		
PP-H-1	19.54		
PP-H-2	37.47	2	$ 74.94
PP-H-3	21.98		
PP-H-4	51.69		

DIS-SL-DF	Unit Cost	Qty	Total Cost

Insulation: 0.00 NONE

Repair SetUp Charge = $ 514

IP12_004375

Maintenance, Repair & Replacement Analysis

Building:	9BSE-G - General Services	Area Cost Index:	$1.00
Section:	9BSEGC	Roof Replacement Cost:	$5.25 per SF
Section Area:	288	Insulation Replacement Cost:	$8.00 per SF

Originally Constructed/Last Replaced:	1985	Visual Inspection Date:	5/17/2001
Current Age:	16 Year(s)	Insulation Inspection Date:	--------

Predicted Year of Replacement (w/o repairs):			2007				
Additional Service Life (w/repairs):			5	Year(s)		Current	Improved
Predicted Year of Replacement (w/repairs):			2012		ICI	100	100
					FCI	50	80
Cost for Repairs:	$	1017.00	203.40	$/year	MCI	100	100
Cost for Replacement:	$	1512.00	76.00	$/year	RCI	65	86

Adjusted Repair/Replace Ratio = 2.85 Recommendation: Replace

IP12_004376

Generated: Jul/13/2001

Corrective Action Requirement Sheet

Major Repair

(Note: Attach a copy of this form, along with a copy of the Roof Inspection Worksheet to DA Form 4283

Agency/Inst.:	IPP - Intermountain Power Project	Facility No:	S1430
Bldg No./Sec:	9BSE-G 9BSEGC	Bldg Name:	General Services
Bldg Use:	Maintenance	Inspection Date:	May/2001
Membrane:	BUR: Asphalt	Area (SF):	288
Surfacing:	AGG: Pea Gravel	Age (Yrs):	16
Vapor Ret:	UNKNOWN	Deck Type:	STEEL
Insulation:	EXPANDED POLYSTYRENE	Est. Repair Cost:	$ 1017.00

CORRECTIVE ACTION RECOMMENDED: Maintenance, Repair and/or Partial Replacement

JUSTIFICATION: An economic analysis of the roof condition, including age, indicates that it is more cost effective to accomplish the necessary maintenance, repairs and/or partial replacement of the roofing components rather than replace the roofing system. Therefore, accomplish the following actions for the above roof section.

[Note: numbers refer to identification numbers of distresses corresponding with the Roof Inspection Worksheet]

2.	BF-M-2 96 LF	Prime exposed and deteriorated base flashing and coat with heavy bodied asphalt coating. [2]
3.	DR-M-1 2	Prime and coat surface of roof drains having exposed stripping felts with heavy bodied asphalt coating. [3]

Economic Evaluation Worksheet for a Built-Up Roofing System

Agency/Inst: IPP - Intermountain Power Project | Building/Section: 9BSE-G 9BSEGC | Area: 288 SF | Age: 16

Flashing

DIS-SL-DF	Unit Cost	Qty	Total Cost
BF-H-1	23.37		
BF-H-2	9.97		
BF-H-3	30.69		
BF-M-1	4.72		
BF-M-2	4.78	96	$ 458.88
BF-M-3	5.88		
BF-M-4	19.03		
DR-H-1	27.51		
DR-H-2	51.45		
DR-H-3	47.43		
DR-H-4	102.21		
DR-M-1	21.98	2	$ 43.96
DR-M-2	34.20		
DR-M-3	19.54		
EM-H-1	6.63		
EM-H-2	8.56		
EM-H-3	14.60		
EM-H-4	7.63		
EM-H-5	21.16		
EM-M-2	6.46		
EM-M-3	6.68		
EM-M-4	6.80		
FP-H-1	16.82		
FP-H-2	47.26		
FP-H-3	82.84		
FP-H-4	22.88		
FP-M-1	4.81		
FP-M-2	5.78		
FP-M-3	31.07		
FP-M-4	19.54		
MC-H-1	9.50		
MC-H-2	9.44		
MC-H-3	5.37		
MC-M-1	15.41		
MC-M-2	18.19		
MC-M-3	8.11		
MC-M-4	4.00		
MC-M-5	6.63		
PP-H-1	19.54		
PP-H-2	37.47		
PP-H-3	21.98		
PP-H-4	51.69		

DIS-SL-DF	Unit Cost	Qty	Total Cost

Insulation: 0.00 NONE

Repair SetUp Charge = $ 514

IP12_004378

Maintenance, Repair & Replacement Analysis

Building:	9BSE-G - General Services	Area Cost Index:	$1.00
Section:	9BSEGD	Roof Replacement Cost:	$5.25 per SF
Section Area:	1800	Insulation Replacement Cost:	$8.00 per SF

Originally Constructed/Last Replaced:	1985	Visual Inspection Date:	5/17/2001
Current Age:	16 Year(s)	Insulation Inspection Date:	--------

Predicted Year of Replacement (w/o repairs):			2007				
Additional Service Life (w/repairs):			5	Year(s)		Current	Improved
Predicted Year of Replacement (w/repairs):			2012		ICI	100	100
					FCI	50	80
Cost for Repairs:	$	1578.00	315.60	$/year	MCI	100	100
Cost for Replacement:	$	9450.00	472.00	$/year	RCI	65	86

Adjusted Repair/Replace Ratio = 0.83 Recommendation: Marginal

Generated: Jul/13/2001

Corrective Action Requirement Sheet

Major Repair

(Note: Attach a copy of this form, along with a copy of the Roof Inspection Worksheet to DA Form 4283

Agency/Inst.:	IPP - Intermountain Power Project	Facility No:	S1430
Bldg No./Sec:	9BSE-G 9BSEGD	Bldg Name:	General Services
Bldg Use:	Maintenance	Inspection Date:	May/2001
Membrane:	BUR: Asphalt	Area (SF):	1800
Surfacing:	AGG: Pea Gravel	Age (Yrs):	16
Vapor Ret:	UNKNOWN	Deck Type:	STEEL
Insulation:	EXPANDED POLYSTYRENE	Est. Repair Cost:	$ 1578.00

CORRECTIVE ACTION RECOMMENDED: Maintenance, Repair and/or Partial Replacement

JUSTIFICATION: An economic analysis of the roof condition, including age, indicates that it is more cost effective to accomplish the necessary maintenance, repairs and/or partial replacement of the roofing components rather than replace the roofing system. Therefore, accomplish the following actions for the above roof section.

[Note: numbers refer to identification numbers of distresses corresponding with the Roof Inspection Worksheet]

3.	BF-M-2 180 LF	Prime exposed and deteriorated base flashing and coat with heavy bodied asphalt coating. [3]
4.	MC-M-2 10 LF	Reseal failed joints in metal coping cap and reattach. [4]
5.	DR-M-1 1	Prime and coat surface of roof drains having exposed stripping felts with heavy bodied asphalt coating. [5]

Economic Evaluation Worksheet for a Built-Up Roofing System

Agency/Inst: IPP - Intermountain Power Project | Building/Section: 9BSE-G 9BSEGD | Area: 1800 SF | Age: 16

Flashing

DIS-SL-DF	Unit Cost	Qty	Total Cost
BF-H-1	23.37		
BF-H-2	9.97		
BF-H-3	30.69		
BF-M-1	4.72		
BF-M-2	4.78	180	$ 860.40
BF-M-3	5.88		
BF-M-4	19.03		
DR-H-1	27.51		
DR-H-2	51.45		
DR-H-3	47.43		
DR-H-4	102.21		
DR-M-1	21.98	1	$ 21.98
DR-M-2	34.20		
DR-M-3	19.54		
EM-H-1	6.63		
EM-H-2	8.56		
EM-H-3	14.60		
EM-H-4	7.63		
EM-H-5	21.16		
EM-M-2	6.46		
EM-M-3	6.68		
EM-M-4	6.80		
FP-H-1	16.82		
FP-H-2	47.26		
FP-H-3	82.84		
FP-H-4	22.88		
FP-M-1	4.81		
FP-M-2	5.78		
FP-M-3	31.07		
FP-M-4	19.54		
MC-H-1	9.50		
MC-H-2	9.44		
MC-H-3	5.37		
MC-M-1	15.41		
MC-M-2	18.19	10	$ 181.90
MC-M-3	8.11		
MC-M-4	4.00		
MC-M-5	6.63		
PP-H-1	19.54		
PP-H-2	37.47		
PP-H-3	21.98		
PP-H-4	51.69		

DIS-SL-DF	Unit Cost	Qty	Total Cost

Insulation: 0.00 NONE

Repair SetUp Charge = $ 514

IP12_004381

Maintenance, Repair & Replacement Analysis

Building:	9BSE-G - General Services	Area Cost Index:	$1.00
Section:	9BSEGE	Roof Replacement Cost:	$5.25 per SF
Section Area:	5540	Insulation Replacement Cost:	$8.00 per SF

Originally Constructed/Last Replaced:	1985	Visual Inspection Date:	5/17/2001
Current Age:	16 Year(s)	Insulation Inspection Date:	--------

Predicted Year of Replacement (w/o repairs):			2005				
Additional Service Life (w/repairs):			6	Year(s)		Current	Improved
Predicted Year of Replacement (w/repairs):			2011		ICI	100	100
					FCI	44	80
Cost for Repairs:	$	2262.00	377.00	$/year	MCI	85	85
Cost for Replacement:	$	29085.00	1454.00	$/year	RCI	59	84

Adjusted Repair/Replace Ratio = 0.42 Recommendation: Repair

Generated: Jul/13/2001

Corrective Action Requirement Sheet

Major Repair

(Note: Attach a copy of this form, along with a copy of the Roof Inspection Worksheet to DA Form 4283

Agency/Inst.:	IPP - Intermountain Power Project	Facility No:	S1430
Bldg No./Sec:	9BSE-G 9BSEGE	Bldg Name:	General Services
Bldg Use:	Maintenance	Inspection Date:	May/2001
Membrane:	BUR: Asphalt	Area (SF):	5540
Surfacing:	AGG: Pea Gravel	Age (Yrs):	16
Vapor Ret:	UNKNOWN	Deck Type:	STEEL
Insulation:	EXPANDED POLYSTYRENE	Est. Repair Cost:	$ 2262.00

CORRECTIVE ACTION RECOMMENDED: Maintenance, Repair and/or Partial Replacement

JUSTIFICATION: An economic analysis of the roof condition, including age, indicates that it is more cost effective to accomplish the necessary maintenance, repairs and/or partial replacement of the roofing components rather than replace the roofing system. Therefore, accomplish the following actions for the above roof section.

[Note: numbers refer to identification numbers of distresses corresponding with the Roof Inspection Worksheet]

3.	BF-M-2 304 LF	Prime exposed and deteriorated base flashing and coat with heavy bodied asphalt coating. [3]
4.	DR-M-1 3	Prime and coat surface of roof drains having exposed stripping felts with heavy bodied asphalt coating. [4]
5.	DR-H-3 1	Remove foreign material clogging roof drains. [5]
7.	MC-M-2 10 LF	Reseal failed joints in metal coping cap and reattach. [7]

Economic Evaluation Worksheet for a Built-Up Roofing System

Agency/Inst: IPP - Intermountain Power Project | Building/Section: 9BSE-G 9BSEGE | Area: 5540 SF | Age: 16

Flashing

DIS-SL-DF	Unit Cost	Qty	Total Cost
BF-H-1	23.37		
BF-H-2	9.97		
BF-H-3	30.69		
BF-M-1	4.72		
BF-M-2	4.78	304	$ 1453.12
BF-M-3	5.88		
BF-M-4	19.03		
DR-H-1	27.51		
DR-H-2	51.45		
DR-H-3	47.43	1	$ 47.43
DR-H-4	102.21		
DR-M-1	21.98	3	$ 65.94
DR-M-2	34.20		
DR-M-3	19.54		
EM-H-1	6.63		
EM-H-2	8.56		
EM-H-3	14.60		
EM-H-4	7.63		
EM-H-5	21.16		
EM-M-2	6.46		
EM-M-3	6.68		
EM-M-4	6.80		
FP-H-1	16.82		
FP-H-2	47.26		
FP-H-3	82.84		
FP-H-4	22.88		
FP-M-1	4.81		
FP-M-2	5.78		
FP-M-3	31.07		
FP-M-4	19.54		
MC-H-1	9.50		
MC-H-2	9.44		
MC-H-3	5.37		
MC-M-1	15.41		
MC-M-2	18.19	10	$ 181.90
MC-M-3	8.11		
MC-M-4	4.00		
MC-M-5	6.63		
PP-H-1	19.54		
PP-H-2	37.47		
PP-H-3	21.98		
PP-H-4	51.69		

DIS-SL-DF	Unit Cost	Qty	Total Cost

Insulation: 0.00 NONE

Repair SetUp Charge = $ 514

IP12_004384

Maintenance, Repair & Replacement Analysis

Building: 9BSE-G - General Services
Section: 9BSEGF
Section Area: 3740

Area Cost Index: $1.00
Roof Replacement Cost: $5.25 per SF
Insulation Replacement Cost: $8.00 per SF

Originally Constructed/Last Replaced: 1985
Current Age: 16 Year(s)

Visual Inspection Date: 5/17/2001
Insulation Inspection Date: --------

Predicted Year of Replacement (w/o repairs): 2002
Additional Service Life (w/repairs): 10 Year(s)
Predicted Year of Replacement (w/repairs): 2012

					Current	Improved
				ICI	100	100
				FCI	50	80
Cost for Repairs:	$	52415.00	5241.50 $/year	MCI	29	100
Cost for Replacement:	$	19635.00	982.00 $/year	RCI	43	86

Adjusted Repair/Replace Ratio = 5.50 Recommendation: Replace

Generated: Jul/13/2001

Corrective Action Requirement Sheet

Major Repair

(Note: Attach a copy of this form, along with a copy of the Roof Inspection Worksheet to DA Form 4283

Agency/Inst.:	IPP - Intermountain Power Project	Facility No:	S1430
Bldg No./Sec:	9BSE-G 9BSEGF	Bldg Name:	General Services
Bldg Use:	Maintenance	Inspection Date:	May/2001
Membrane:	BUR: Asphalt	Area (SF):	3740
Surfacing:	AGG: Pea Gravel	Age (Yrs):	16
Vapor Ret:	UNKNOWN	Deck Type:	STEEL
Insulation:	EXPANDED POLYSTYRENE	Est. Repair Cost:	$ 52415.00

CORRECTIVE ACTION RECOMMENDED: Maintenance, Repair and/or Partial Replacement

JUSTIFICATION: An economic analysis of the roof condition, including age, indicates that it is more cost effective to accomplish the necessary maintenance, repairs and/or partial replacement of the roofing components rather than replace the roofing system. Therefore, accomplish the following actions for the above roof section.

[Note: numbers refer to identification numbers of distresses corresponding with the Roof Inspection Worksheet]

3. BF-M-2 350 LF — Prime exposed and deteriorated base flashing and coat with heavy bodied asphalt coating. [3]

4. PA-M-1 3740 SF — Replace patches having inferior repair material with same or better quality than existing membrane. Restore surfacing material. [4]

Economic Evaluation Worksheet for a Built-Up Roofing System

Agency/Inst: IPP - Intermountain Power Project | Building/Section: 9BSE-G 9BSEGF | Area: 3740 SF | Age: 16

Flashing

DIS-SL-DF	Unit Cost	Qty	Total Cost
BF-H-1	23.37		
BF-H-2	9.97		
BF-H-3	30.69		
BF-M-1	4.72		
BF-M-2	4.78	350	$ 1673.00
BF-M-3	5.88		
BF-M-4	19.03		
DR-H-1	27.51		
DR-H-2	51.45		
DR-H-3	47.43		
DR-H-4	102.21		
DR-M-1	21.98		
DR-M-2	34.20		
DR-M-3	19.54		
EM-H-1	6.63		
EM-H-2	8.56		
EM-H-3	14.60		
EM-H-4	7.63		
EM-H-5	21.16		
EM-M-2	6.46		
EM-M-3	6.68		
EM-M-4	6.80		
FP-H-1	16.82		
FP-H-2	47.26		
FP-H-3	82.84		
FP-H-4	22.88		
FP-M-1	4.81		
FP-M-2	5.78		
FP-M-3	31.07		
FP-M-4	19.54		
MC-H-1	9.50		
MC-H-2	9.44		
MC-H-3	5.37		
MC-M-1	15.41		
MC-M-2	18.19		
MC-M-3	8.11		
MC-M-4	4.00		
MC-M-5	6.63		
PP-H-1	19.54		
PP-H-2	37.47		
PP-H-3	21.98		
PP-H-4	51.69		

DIS-SL-DF	Unit Cost	Qty	Total Cost

Insulation: 0.00 NONE

Repair SetUp Charge = $ 514

IP12_004387

Maintenance, Repair & Replacement Analysis

Building:	9BSE-G - General Services	Area Cost Index:	$1.00
Section:	9BSEGG	Roof Replacement Cost:	$5.25 per SF
Section Area:	4920	Insulation Replacement Cost:	$8.00 per SF

Originally Constructed/Last Replaced:	1985	Visual Inspection Date:	5/17/2001
Current Age:	16 Year(s)	Insulation Inspection Date:	--------

Predicted Year of Replacement (w/o repairs):			2006				
Additional Service Life (w/repairs):			6	Year(s)		Current	Improved
Predicted Year of Replacement (w/repairs):			2012		ICI	100	100
					FCI	50	80
Cost for Repairs:	$	5558.00	926.33	$/year	MCI	78	100
Cost for Replacement:	$	25830.00	1292.00	$/year	RCI	62	86

Adjusted Repair/Replace Ratio = 0.88 Recommendation: Marginal

Generated: Jul/13/2001

Corrective Action Requirement Sheet

Major Repair

(Note: Attach a copy of this form, along with a copy of the Roof Inspection Worksheet to DA Form 4283

Agency/Inst.:	IPP - Intermountain Power Project	Facility No:	S1430
Bldg No./Sec:	9BSE-G 9BSEGG	Bldg Name:	General Services
Bldg Use:	Maintenance	Inspection Date:	May/2001
Membrane:	BUR: Asphalt	Area (SF):	4920
Surfacing:	AGG: Pea Gravel	Age (Yrs):	16
Vapor Ret:	UNKNOWN	Deck Type:	STEEL
Insulation:	EXPANDED POLYSTYRENE	Est. Repair Cost:	$ 5558.00

CORRECTIVE ACTION RECOMMENDED: Maintenance, Repair and/or Partial Replacement

JUSTIFICATION: An economic analysis of the roof condition, including age, indicates that it is more cost effective to accomplish the necessary maintenance, repairs and/or partial replacement of the roofing components rather than replace the roofing system. Therefore, accomplish the following actions for the above roof section.

[Note: numbers refer to identification numbers of distresses corresponding with the Roof Inspection Worksheet]

3. BF-M-2 348 LF — Prime exposed and deteriorated base flashing and coat with heavy bodied asphalt coating. [3]

4. BF-H-1 1 LF — Repair damaged base flashing by overlaying each localized defect with new base flashing. [4]

5. PA-M-1 250 SF — Replace patches having inferior repair material with same or better quality than existing membrane. Restore surfacing material. [5]

Economic Evaluation Worksheet for a Built-Up Roofing System

Agency/Inst: IPP - Intermountain Power Project | Building/Section: 9BSE-G 9BSEGG | Area: 4920 SF | Age: 16

Flashing

DIS-SL-DF	Unit Cost	Qty	Total Cost
BF-H-1	23.37	1	$ 23.37
BF-H-2	9.97		
BF-H-3	30.69		
BF-M-1	4.72		
BF-M-2	4.78	348	$ 1663.44
BF-M-3	5.88		
BF-M-4	19.03		
DR-H-1	27.51		
DR-H-2	51.45		
DR-H-3	47.43		
DR-H-4	102.21		
DR-M-1	21.98		
DR-M-2	34.20		
DR-M-3	19.54		
EM-H-1	6.63		
EM-H-2	8.56		
EM-H-3	14.60		
EM-H-4	7.63		
EM-H-5	21.16		
EM-M-2	6.46		
EM-M-3	6.68		
EM-M-4	6.80		
FP-H-1	16.82		
FP-H-2	47.26		
FP-H-3	82.84		
FP-H-4	22.88		
FP-M-1	4.81		
FP-M-2	5.78		
FP-M-3	31.07		
FP-M-4	19.54		
MC-H-1	9.50		
MC-H-2	9.44		
MC-H-3	5.37		
MC-M-1	15.41		
MC-M-2	18.19		
MC-M-3	8.11		
MC-M-4	4.00		
MC-M-5	6.63		
PP-H-1	19.54		
PP-H-2	37.47		
PP-H-3	21.98		
PP-H-4	51.69		

DIS-SL-DF	Unit Cost	Qty	Total Cost

Insulation: 0.00 NONE

Repair SetUp Charge = $ 514

Maintenance, Repair & Replacement Analysis

Building:	9BSE-G - General Services	Area Cost Index:	$1.00
Section:	9BSEGH	Roof Replacement Cost:	$5.25 per SF
Section Area:	4920	Insulation Replacement Cost:	$8.00 per SF

Originally Constructed/Last Replaced:	1985	Visual Inspection Date:	5/17/2001
Current Age:	16 Year(s)	Insulation Inspection Date:	--------

Predicted Year of Replacement (w/o repairs):			2006				
Additional Service Life (w/repairs):			5	Year(s)		Current	Improved
Predicted Year of Replacement (w/repairs):			2011		ICI	100	100
					FCI	50	80
Cost for Repairs:	$	3349.00	669.80	$/year	MCI	81	84
Cost for Replacement:	$	25830.00	1292.00	$/year	RCI	62	84

Adjusted Repair/Replace Ratio = 0.68 Recommendation: Repair

Generated: Jul/13/2001

Corrective Action Requirement Sheet

Major Repair

(Note: Attach a copy of this form, along with a copy of the Roof Inspection Worksheet to DA Form 4283

Agency/Inst.:	IPP - Intermountain Power Project	Facility No:	S1430
Bldg No./Sec:	9BSE-G 9BSEGH	Bldg Name:	General Services
Bldg Use:	Maintenance	Inspection Date:	May/2001
Membrane:	BUR: Asphalt	Area (SF):	4920
Surfacing:	AGG: Pea Gravel	Age (Yrs):	16
Vapor Ret:	UNKNOWN	Deck Type:	STEEL
Insulation:	EXPANDED POLYSTYRENE	Est. Repair Cost:	$ 3349.00

CORRECTIVE ACTION RECOMMENDED: Maintenance, Repair and/or Partial Replacement

JUSTIFICATION: An economic analysis of the roof condition, including age, indicates that it is more cost effective to accomplish the necessary maintenance, repairs and/or partial replacement of the roofing components rather than replace the roofing system. Therefore, accomplish the following actions for the above roof section.

[Note: numbers refer to identification numbers of distresses corresponding with the Roof Inspection Worksheet]

3.	BF-M-2 448 LF	Prime exposed and deteriorated base flashing and coat with heavy bodied asphalt coating. [3]
4.	DR-M-1 3	Prime and coat surface of roof drains having exposed stripping felts with heavy bodied asphalt coating. [4]
6.	PA-M-1 40 SF	Replace patches having inferior repair material with same or better quality than existing membrane. Restore surfacing material. [6]
7.	MC-M-2 5 LF	Reseal failed joints in metal coping cap and reattach. [7]

Economic Evaluation Worksheet for a Built-Up Roofing System

Agency/Inst: IPP - Intermountain Power Project | Building/Section: 9BSE-G 9BSEGH | Area: 4920 SF | Age: 16

Flashing

DIS-SL-DF	Unit Cost	Qty	Total Cost
BF-H-1	23.37		
BF-H-2	9.97		
BF-H-3	30.69		
BF-M-1	4.72		
BF-M-2	4.78	448	$ 2141.44
BF-M-3	5.88		
BF-M-4	19.03		
DR-H-1	27.51		
DR-H-2	51.45		
DR-H-3	47.43		
DR-H-4	102.21		
DR-M-1	21.98	3	$ 65.94
DR-M-2	34.20		
DR-M-3	19.54		
EM-H-1	6.63		
EM-H-2	8.56		
EM-H-3	14.60		
EM-H-4	7.63		
EM-H-5	21.16		
EM-M-2	6.46		
EM-M-3	6.68		
EM-M-4	6.80		
FP-H-1	16.82		
FP-H-2	47.26		
FP-H-3	82.84		
FP-H-4	22.88		
FP-M-1	4.81		
FP-M-2	5.78		
FP-M-3	31.07		
FP-M-4	19.54		
MC-H-1	9.50		
MC-H-2	9.44		
MC-H-3	5.37		
MC-M-1	15.41		
MC-M-2	18.19	5	$ 90.95
MC-M-3	8.11		
MC-M-4	4.00		
MC-M-5	6.63		
PP-H-1	19.54		
PP-H-2	37.47		
PP-H-3	21.98		
PP-H-4	51.69		

DIS-SL-DF	Unit Cost	Qty	Total Cost

Insulation: 0.00 NONE

Repair SetUp Charge = $ 514

IP12_004393

Maintenance, Repair & Replacement Analysis

Building:	9BSE-G - General Services	Area Cost Index:	$1.00
Section:	9BSEGI	Roof Replacement Cost:	$5.25 per SF
Section Area:	5400	Insulation Replacement Cost:	$8.00 per SF

Originally Constructed/Last Replaced:	1985	Visual Inspection Date:	5/17/2001
Current Age:	16 Year(s)	Insulation Inspection Date:	--------

Predicted Year of Replacement (w/o repairs):			2006				
Additional Service Life (w/repairs):			5	Year(s)		Current	Improved
Predicted Year of Replacement (w/repairs):			2011		ICI	100	100
					FCI	50	80
Cost for Repairs:	$	3236.00	647.20	$/year	MCI	85	85
Cost for Replacement:	$	28350.00	1418.00	$/year	RCI	63	84

Adjusted Repair/Replace Ratio = 0.62 Recommendation: Repair

Generated: Jul/13/2001

Corrective Action Requirement Sheet

Major Repair

(Note: Attach a copy of this form, along with a copy of the Roof Inspection Worksheet to DA Form 4283

Agency/Inst.:	IPP - Intermountain Power Project	Facility No:	S1430
Bldg No./Sec:	9BSE-G 9BSEGI	Bldg Name:	General Services
Bldg Use:	Maintenance	Inspection Date:	May/2001
Membrane:	BUR: Asphalt	Area (SF):	5400
Surfacing:	AGG: Pea Gravel	Age (Yrs):	16
Vapor Ret:	UNKNOWN	Deck Type:	None
Insulation:	EXPANDED POLYSTYRENE	Est. Repair Cost:	$ 3236.00

CORRECTIVE ACTION RECOMMENDED: Maintenance, Repair and/or Partial Replacement

JUSTIFICATION: An economic analysis of the roof condition, including age, indicates that it is more cost effective to accomplish the necessary maintenance, repairs and/or partial replacement of the roofing components rather than replace the roofing system. Therefore, accomplish the following actions for the above roof section.

[Note: numbers refer to identification numbers of distresses corresponding with the Roof Inspection Worksheet]

3.	BF-M-2 522 LF	Prime exposed and deteriorated base flashing and coat with heavy bodied asphalt coating. [3]
4.	BF-H-1 3 LF	Repair damaged base flashing by overlaying each localized defect with new base flashing. [4]
5.	DR-M-1 3	Prime and coat surface of roof drains having exposed stripping felts with heavy bodied asphalt coating. [5]
7.	MC-M-2 5 LF	Reseal failed joints in metal coping cap and reattach. [7]

Economic Evaluation Worksheet for a Built-Up Roofing System

Agency/Inst: IPP - Intermountain Power Project | Building/Section: 9BSE-G 9BSEGI | Area: 5400 SF | Age: 16

Flashing

DIS-SL-DF	Unit Cost	Qty	Total Cost
BF-H-1	23.37	3	$ 70.11
BF-H-2	9.97		
BF-H-3	30.69		
BF-M-1	4.72		
BF-M-2	4.78	522	$ 2495.16
BF-M-3	5.88		
BF-M-4	19.03		
DR-H-1	27.51		
DR-H-2	51.45		
DR-H-3	47.43		
DR-H-4	102.21		
DR-M-1	21.98	3	$ 65.94
DR-M-2	34.20		
DR-M-3	19.54		
EM-H-1	6.63		
EM-H-2	8.56		
EM-H-3	14.60		
EM-H-4	7.63		
EM-H-5	21.16		
EM-M-2	6.46		
EM-M-3	6.68		
EM-M-4	6.80		
FP-H-1	16.82		
FP-H-2	47.26		
FP-H-3	82.84		
FP-H-4	22.88		
FP-M-1	4.81		
FP-M-2	5.78		
FP-M-3	31.07		
FP-M-4	19.54		
MC-H-1	9.50		
MC-H-2	9.44		
MC-H-3	5.37		
MC-M-1	15.41		
MC-M-2	18.19	5	$ 90.95
MC-M-3	8.11		
MC-M-4	4.00		
MC-M-5	6.63		
PP-H-1	19.54		
PP-H-2	37.47		
PP-H-3	21.98		
PP-H-4	51.69		

DIS-SL-DF	Unit Cost	Qty	Total Cost

Insulation: 0.00 NONE

Repair SetUp Charge = $ 514

Maintenance, Repair & Replacement Analysis

Building:	9BSE-G - General Services	Area Cost Index:	$1.00
Section:	9BSEGJ	Roof Replacement Cost:	$5.25 per SF
Section Area:	1870	Insulation Replacement Cost:	$8.00 per SF

Originally Constructed/Last Replaced:	1985	Visual Inspection Date:	5/17/2001
Current Age:	16 Year(s)	Insulation Inspection Date:	--------

						Current	Improved
Predicted Year of Replacement (w/o repairs):		2006					
Additional Service Life (w/repairs):		6	Year(s)		ICI	100	100
Predicted Year of Replacement (w/repairs):		2012			FCI	50	80
Cost for Repairs:	$ 2271.00	378.50	$/year		MCI	82	100
Cost for Replacement:	$ 9817.50	491.00	$/year		RCI	62	86

Adjusted Repair/Replace Ratio = 0.93 Recommendation: Marginal

Generated: Jul/13/2001

Corrective Action Requirement Sheet

Major Repair

(Note: Attach a copy of this form, along with a copy of the Roof Inspection Worksheet to DA Form 4283

Agency/Inst.:	IPP - Intermountain Power Project	Facility No:	S1430
Bldg No./Sec:	9BSE-G 9BSEGJ	Bldg Name:	General Services
Bldg Use:	Maintenance	Inspection Date:	May/2001
Membrane:	BUR: Asphalt	Area (SF):	1870
Surfacing:	AGG: Pea Gravel	Age (Yrs):	16
Vapor Ret:	UNKNOWN	Deck Type:	STEEL
Insulation:	EXPANDED POLYSTYRENE	Est. Repair Cost:	$ 2271.00

CORRECTIVE ACTION RECOMMENDED: Maintenance, Repair and/or Partial Replacement

JUSTIFICATION: An economic analysis of the roof condition, including age, indicates that it is more cost effective to accomplish the necessary maintenance, repairs and/or partial replacement of the roofing components rather than replace the roofing system. Therefore, accomplish the following actions for the above roof section.

[Note: numbers refer to identification numbers of distresses corresponding with the Roof Inspection Worksheet]

2.	BF-M-2 184 LF	Prime exposed and deteriorated base flashing and coat with heavy bodied asphalt coating. [2]
3.	DR-M-1 2	Prime and coat surface of roof drains having exposed stripping felts with heavy bodied asphalt coating. [3]
4.	PA-M-1 62 SF	Replace patches having inferior repair material with same or better quality than existing membrane. Restore surfacing material. [4]

Economic Evaluation Worksheet for a Built-Up Roofing System

Agency/Inst: IPP - Intermountain Power Project | Building/Section: 9BSE-G 9BSEGJ | Area: 1870 SF | Age: 16

Flashing

DIS-SL-DF	Unit Cost	Qty	Total Cost
BF-H-1	23.37		
BF-H-2	9.97		
BF-H-3	30.69		
BF-M-1	4.72		
BF-M-2	4.78	184	$ 879.52
BF-M-3	5.88		
BF-M-4	19.03		
DR-H-1	27.51		
DR-H-2	51.45		
DR-H-3	47.43		
DR-H-4	102.21		
DR-M-1	21.98	2	$ 43.96
DR-M-2	34.20		
DR-M-3	19.54		
EM-H-1	6.63		
EM-H-2	8.56		
EM-H-3	14.60		
EM-H-4	7.63		
EM-H-5	21.16		
EM-M-2	6.46		
EM-M-3	6.68		
EM-M-4	6.80		
FP-H-1	16.82		
FP-H-2	47.26		
FP-H-3	82.84		
FP-H-4	22.88		
FP-M-1	4.81		
FP-M-2	5.78		
FP-M-3	31.07		
FP-M-4	19.54		
MC-H-1	9.50		
MC-H-2	9.44		
MC-H-3	5.37		
MC-M-1	15.41		
MC-M-2	18.19		
MC-M-3	8.11		
MC-M-4	4.00		
MC-M-5	6.63		
PP-H-1	19.54		
PP-H-2	37.47		
PP-H-3	21.98		
PP-H-4	51.69		

DIS-SL-DF	Unit Cost	Qty	Total Cost

Insulation: 0.00 NONE

Repair SetUp Charge = $ 514

IP12_004399

Maintenance, Repair & Replacement Analysis

Building:	9BSE-G - General Services	Area Cost Index:	$1.00
Section:	9BSEGK	Roof Replacement Cost:	$5.25 per SF
Section Area:	3158	Insulation Replacement Cost:	$8.00 per SF

Originally Constructed/Last Replaced:	1985	Visual Inspection Date:	5/17/2001
Current Age:	16 Year(s)	Insulation Inspection Date:	--------

Predicted Year of Replacement (w/o repairs):			2003				
Additional Service Life (w/repairs):			9	Year(s)		Current	Improved
Predicted Year of Replacement (w/repairs):			2012		ICI	100	100
					FCI	50	80
Cost for Repairs:	$	34434.00	3826.00	$/year	MCI	36	100
Cost for Replacement:	$	16579.50	829.00	$/year	RCI	48	86

Adjusted Repair/Replace Ratio = 4.78 Recommendation: Replace

Generated: Jul/13/2001

Corrective Action Requirement Sheet

Major Repair

(Note: Attach a copy of this form, along with a copy of the Roof Inspection Worksheet to DA Form 4283

Agency/Inst.:	IPP - Intermountain Power Project	Facility No:	S1430
Bldg No./Sec:	9BSE-G 9BSEGK	Bldg Name:	General Services
Bldg Use:	Maintenance	Inspection Date:	May/2001
Membrane:	BUR: Asphalt	Area (SF):	3158
Surfacing:	AGG: Pea Gravel	Age (Yrs):	16
Vapor Ret:	UNKNOWN	Deck Type:	STEEL
Insulation:	EXPANDED POLYSTYRENE	Est. Repair Cost:	$ 34434.00

CORRECTIVE ACTION RECOMMENDED: Maintenance, Repair and/or Partial Replacement

JUSTIFICATION: An economic analysis of the roof condition, including age, indicates that it is more cost effective to accomplish the necessary maintenance, repairs and/or partial replacement of the roofing components rather than replace the roofing system. Therefore, accomplish the following actions for the above roof section.

[Note: numbers refer to identification numbers of distresses corresponding with the Roof Inspection Worksheet]

3.	BF-M-2 334 LF	Prime exposed and deteriorated base flashing and coat with heavy bodied asphalt coating. [3]
4.	PA-M-1 2400 SF	Replace patches having inferior repair material with same or better quality than existing membrane. Restore surfacing material. [4]
5.	MC-M-2 5 LF	Reseal failed joints in metal coping cap and reattach. [5]

Economic Evaluation Worksheet for a Built-Up Roofing System

Agency/Inst: IPP - Intermountain Power Project | Building/Section: 9BSE-G 9BSEGK | Area: 3158 SF | Age: 16

Flashing

DIS-SL-DF	Unit Cost	Qty	Total Cost
BF-H-1	23.37		
BF-H-2	9.97		
BF-H-3	30.69		
BF-M-1	4.72		
BF-M-2	4.78	334	$ 1596.52
BF-M-3	5.88		
BF-M-4	19.03		
DR-H-1	27.51		
DR-H-2	51.45		
DR-H-3	47.43		
DR-H-4	102.21		
DR-M-1	21.98		
DR-M-2	34.20		
DR-M-3	19.54		
EM-H-1	6.63		
EM-H-2	8.56		
EM-H-3	14.60		
EM-H-4	7.63		
EM-H-5	21.16		
EM-M-2	6.46		
EM-M-3	6.68		
EM-M-4	6.80		
FP-H-1	16.82		
FP-H-2	47.26		
FP-H-3	82.84		
FP-H-4	22.88		
FP-M-1	4.81		
FP-M-2	5.78		
FP-M-3	31.07		
FP-M-4	19.54		
MC-H-1	9.50		
MC-H-2	9.44		
MC-H-3	5.37		
MC-M-1	15.41		
MC-M-2	18.19	5	$ 90.95
MC-M-3	8.11		
MC-M-4	4.00		
MC-M-5	6.63		
PP-H-1	19.54		
PP-H-2	37.47		
PP-H-3	21.98		
PP-H-4	51.69		

DIS-SL-DF	Unit Cost	Qty	Total Cost

Insulation: 0.00 NONE

Repair SetUp Charge = $ 514

IP12_004402

Maintenance, Repair & Replacement Analysis

Building:	9BSE-G - General Services	Area Cost Index:	$1.00
Section:	9BSEGL	Roof Replacement Cost:	$5.25 per SF
Section Area:	8100	Insulation Replacement Cost:	$8.00 per SF

Originally Constructed/Last Replaced:	1985	Visual Inspection Date:	5/17/2001
Current Age:	16 Year(s)	Insulation Inspection Date:	--------

Predicted Year of Replacement (w/o repairs):			2006				
Additional Service Life (w/repairs):			6	Year(s)		Current	Improved
Predicted Year of Replacement (w/repairs):			2012		ICI	100	100
					FCI	50	80
Cost for Repairs:	$	5219.00	869.83	$/year	MCI	86	100
Cost for Replacement:	$	42525.00	2126.00	$/year	RCI	63	86

Adjusted Repair/Replace Ratio = 0.57 Recommendation: Repair

IP12_004403

Generated: Jul/13/2001

Corrective Action Requirement Sheet

Major Repair

(Note: Attach a copy of this form, along with a copy of the Roof Inspection Worksheet to DA Form 4283

Agency/Inst.:	IPP - Intermountain Power Project	Facility No:	S1430
Bldg No./Sec:	9BSE-G 9BSEGL	Bldg Name:	General Services
Bldg Use:	Maintenance	Inspection Date:	May/2001
Membrane:	BUR: Asphalt	Area (SF):	8100
Surfacing:	AGG: Pea Gravel	Age (Yrs):	16
Vapor Ret:	UNKNOWN	Deck Type:	STEEL
Insulation:	EXPANDED POLYSTYRENE	Est. Repair Cost:	$ 5219.00

CORRECTIVE ACTION RECOMMENDED: Maintenance, Repair and/or Partial Replacement

JUSTIFICATION: An economic analysis of the roof condition, including age, indicates that it is more cost effective to accomplish the necessary maintenance, repairs and/or partial replacement of the roofing components rather than replace the roofing system. Therefore, accomplish the following actions for the above roof section.

[Note: numbers refer to identification numbers of distresses corresponding with the Roof Inspection Worksheet]

3.	BF-M-2 535 LF	Prime exposed and deteriorated base flashing and coat with heavy bodied asphalt coating. [3]
4.	BF-H-1 2 LF	Repair damaged base flashing by overlaying each localized defect with new base flashing. [4]
5.	PA-M-1 150 SF	Replace patches having inferior repair material with same or better quality than existing membrane. Restore surfacing material. [5]
6.	DR-M-1 3	Prime and coat surface of roof drains having exposed stripping felts with heavy bodied asphalt coating. [6]
7.	SR-M-1 10 SF	Reinstall aggregate on exposed membrane surfaces. [7]

Economic Evaluation Worksheet for a Built-Up Roofing System

Agency/Inst: IPP - Intermountain Power Project | Building/Section: 9BSE-G 9BSEGL | Area: 8100 SF | Age: 16

Flashing

DIS-SL-DF	Unit Cost	Qty	Total Cost
BF-H-1	23.37	2	$ 46.74
BF-H-2	9.97		
BF-H-3	30.69		
BF-M-1	4.72		
BF-M-2	4.78	535	$ 2557.30
BF-M-3	5.88		
BF-M-4	19.03		
DR-H-1	27.51		
DR-H-2	51.45		
DR-H-3	47.43		
DR-H-4	102.21		
DR-M-1	21.98	3	$ 65.94
DR-M-2	34.20		
DR-M-3	19.54		
EM-H-1	6.63		
EM-H-2	8.56		
EM-H-3	14.60		
EM-H-4	7.63		
EM-H-5	21.16		
EM-M-2	6.46		
EM-M-3	6.68		
EM-M-4	6.80		
FP-H-1	16.82		
FP-H-2	47.26		
FP-H-3	82.84		
FP-H-4	22.88		
FP-M-1	4.81		
FP-M-2	5.78		
FP-M-3	31.07		
FP-M-4	19.54		
MC-H-1	9.50		
MC-H-2	9.44		
MC-H-3	5.37		
MC-M-1	15.41		
MC-M-2	18.19		
MC-M-3	8.11		
MC-M-4	4.00		
MC-M-5	6.63		
PP-H-1	19.54		
PP-H-2	37.47		
PP-H-3	21.98		
PP-H-4	51.69		

DIS-SL-DF	Unit Cost	Qty	Total Cost

Insulation: 0.00 NONE

Repair SetUp Charge = $ 514

IP12_004405

Maintenance, Repair & Replacement Analysis

Building: 9BSE-G - General Services
Section: 9BSEGM
Section Area: 8100

Area Cost Index: $1.00
Roof Replacement Cost: $5.25 per SF
Insulation Replacement Cost: $8.00 per SF

Originally Constructed/Last Replaced: 1985
Current Age: 16 Year(s)

Visual Inspection Date: 5/17/2001
Insulation Inspection Date: --------

Predicted Year of Replacement (w/o repairs): 2007
Additional Service Life (w/repairs): 5 Year(s)
Predicted Year of Replacement (w/repairs): 2012

					Current	Improved
				ICI	100	100
				FCI	50	80
Cost for Repairs:	$ 3151.00	630.20	$/year	MCI	100	100
Cost for Replacement:	$ 42525.00	2126.00	$/year	RCI	65	86

Adjusted Repair/Replace Ratio = 0.46

Recommendation: Repair

Generated: Jul/13/2001

Corrective Action Requirement Sheet

Major Repair

(Note: Attach a copy of this form, along with a copy of the Roof Inspection Worksheet to DA Form 4283

Agency/Inst.:	IPP - Intermountain Power Project	Facility No:	S1430
Bldg No./Sec:	9BSE-G 9BSEGM	Bldg Name:	General Services
Bldg Use:	Maintenance	Inspection Date:	May/2001
Membrane:	BUR: Asphalt	Area (SF):	8100
Surfacing:	AGG: Pea Gravel	Age (Yrs):	16
Vapor Ret:	UNKNOWN	Deck Type:	STEEL
Insulation:	EXPANDED POLYSTYRENE	Est. Repair Cost:	$ 3151.00

CORRECTIVE ACTION RECOMMENDED: Maintenance, Repair and/or Partial Replacement

JUSTIFICATION: An economic analysis of the roof condition, including age, indicates that it is more cost effective to accomplish the necessary maintenance, repairs and/or partial replacement of the roofing components rather than replace the roofing system. Therefore, accomplish the following actions for the above roof section.

[Note: numbers refer to identification numbers of distresses corresponding with the Roof Inspection Worksheet]

3.	BF-M-2 528 LF	Prime exposed and deteriorated base flashing and coat with heavy bodied asphalt coating. [3]
4.	BF-H-1 2 LF	Repair damaged base flashing by overlaying each localized defect with new base flashing. [4]
6.	DR-M-1 3	Prime and coat surface of roof drains having exposed stripping felts with heavy bodied asphalt coating. [6]

Economic Evaluation Worksheet for a Built-Up Roofing System

Agency/Inst: IPP - Intermountain Power Project | Building/Section: 9BSE-G 9BSEGM | Area: 8100 SF | Age: 16

Flashing

DIS-SL-DF	Unit Cost	Qty	Total Cost
BF-H-1	23.37	2	$ 46.74
BF-H-2	9.97		
BF-H-3	30.69		
BF-M-1	4.72		
BF-M-2	4.78	528	$ 2523.84
BF-M-3	5.88		
BF-M-4	19.03		
DR-H-1	27.51		
DR-H-2	51.45		
DR-H-3	47.43		
DR-H-4	102.21		
DR-M-1	21.98	3	$ 65.94
DR-M-2	34.20		
DR-M-3	19.54		
EM-H-1	6.63		
EM-H-2	8.56		
EM-H-3	14.60		
EM-H-4	7.63		
EM-H-5	21.16		
EM-M-2	6.46		
EM-M-3	6.68		
EM-M-4	6.80		
FP-H-1	16.82		
FP-H-2	47.26		
FP-H-3	82.84		
FP-H-4	22.88		
FP-M-1	4.81		
FP-M-2	5.78		
FP-M-3	31.07		
FP-M-4	19.54		
MC-H-1	9.50		
MC-H-2	9.44		
MC-H-3	5.37		
MC-M-1	15.41		
MC-M-2	18.19		
MC-M-3	8.11		
MC-M-4	4.00		
MC-M-5	6.63		
PP-H-1	19.54		
PP-H-2	37.47		
PP-H-3	21.98		
PP-H-4	51.69		

DIS-SL-DF	Unit Cost	Qty	Total Cost

Insulation: 0.00 NONE

Repair SetUp Charge = $ 514

IP12_004408

Maintenance, Repair & Replacement Analysis

Building:	9BSE-G - General Services	Area Cost Index:	$1.00
Section:	9BSEGN	Roof Replacement Cost:	$5.25 per SF
Section Area:	8100	Insulation Replacement Cost:	$8.00 per SF

Originally Constructed/Last Replaced:	1985	Visual Inspection Date:	5/17/2001
Current Age:	16 Year(s)	Insulation Inspection Date:	--------

Predicted Year of Replacement (w/o repairs):			2006				
Additional Service Life (w/repairs):			5	Year(s)		Current	Improved
Predicted Year of Replacement (w/repairs):			2011		ICI	100	100
					FCI	50	80
Cost for Repairs:	$	3188.00	637.60	$/year	MCI	89	89
Cost for Replacement:	$	42525.00	2126.00	$/year	RCI	63	84

Adjusted Repair/Replace Ratio = 0.46 Recommendation: Repair

Generated: Jul/13/2001

Corrective Action Requirement Sheet

Major Repair

(Note: Attach a copy of this form, along with a copy of the Roof Inspection Worksheet to DA Form 4283

Agency/Inst.:	IPP - Intermountain Power Project	Facility No:	S1430
Bldg No./Sec:	9BSE-G 9BSEGN	Bldg Name:	General Services
Bldg Use:	Maintenance	Inspection Date:	May/2001
Membrane:	BUR: Asphalt	Area (SF):	8100
Surfacing:	AGG: Pea Gravel	Age (Yrs):	16
Vapor Ret:	UNKNOWN	Deck Type:	STEEL
Insulation:	EXPANDED POLYSTYRENE	Est. Repair Cost:	$ 3188.00

CORRECTIVE ACTION RECOMMENDED: Maintenance, Repair and/or Partial Replacement

JUSTIFICATION: An economic analysis of the roof condition, including age, indicates that it is more cost effective to accomplish the necessary maintenance, repairs and/or partial replacement of the roofing components rather than replace the roofing system. Therefore, accomplish the following actions for the above roof section.

[Note: numbers refer to identification numbers of distresses corresponding with the Roof Inspection Worksheet]

3.	BF-M-2 512 LF	Prime exposed and deteriorated base flashing and coat with heavy bodied asphalt coating. [3]
4.	BF-H-1 3 LF	Repair damaged base flashing by overlaying each localized defect with new base flashing. [4]
5.	DR-M-1 3	Prime and coat surface of roof drains having exposed stripping felts with heavy bodied asphalt coating. [5]
7.	MC-M-2 5 LF	Reseal failed joints in metal coping cap and reattach. [7]

Economic Evaluation Worksheet for a Built-Up Roofing System

Agency/Inst: IPP - Intermountain Power Project | Building/Section: 9BSE-G 9BSEGN | Area: 8100 SF | Age: 16

Flashing

DIS-SL-DF	Unit Cost	Qty	Total Cost
BF-H-1	23.37	3	$ 70.11
BF-H-2	9.97		
BF-H-3	30.69		
BF-M-1	4.72		
BF-M-2	4.78	512	$ 2447.36
BF-M-3	5.88		
BF-M-4	19.03		
DR-H-1	27.51		
DR-H-2	51.45		
DR-H-3	47.43		
DR-H-4	102.21		
DR-M-1	21.98	3	$ 65.94
DR-M-2	34.20		
DR-M-3	19.54		
EM-H-1	6.63		
EM-H-2	8.56		
EM-H-3	14.60		
EM-H-4	7.63		
EM-H-5	21.16		
EM-M-2	6.46		
EM-M-3	6.68		
EM-M-4	6.80		
FP-H-1	16.82		
FP-H-2	47.26		
FP-H-3	82.84		
FP-H-4	22.88		
FP-M-1	4.81		
FP-M-2	5.78		
FP-M-3	31.07		
FP-M-4	19.54		
MC-H-1	9.50		
MC-H-2	9.44		
MC-H-3	5.37		
MC-M-1	15.41		
MC-M-2	18.19	5	$ 90.95
MC-M-3	8.11		
MC-M-4	4.00		
MC-M-5	6.63		
PP-H-1	19.54		
PP-H-2	37.47		
PP-H-3	21.98		
PP-H-4	51.69		

DIS-SL-DF	Unit Cost	Qty	Total Cost

Insulation: 0.00 NONE

Repair SetUp Charge = $ 514

IP12_004411

Maintenance, Repair & Replacement Analysis

Building:	9BSE-G - General Services	Area Cost Index:	$1.00
Section:	9BSEGO	Roof Replacement Cost:	$5.25 per SF
Section Area:	8156	Insulation Replacement Cost:	$8.00 per SF

Originally Constructed/Last Replaced:	1985	Visual Inspection Date:	5/17/2001
Current Age:	16 Year(s)	Insulation Inspection Date:	--------

Predicted Year of Replacement (w/o repairs):			2005				
Additional Service Life (w/repairs):			6	Year(s)		Current	Improved
Predicted Year of Replacement (w/repairs):			2011		ICI	100	100
					FCI	43	80
Cost for Repairs:	$	3443.00	573.83	$/year	MCI	86	86
Cost for Replacement:	$	42819.00	2141.00	$/year	RCI	58	84

Adjusted Repair/Replace Ratio = 0.43 Recommendation: Repair

Generated: Jul/13/2001

Corrective Action Requirement Sheet

Major Repair

(Note: Attach a copy of this form, along with a copy of the Roof Inspection Worksheet to DA Form 4283

Agency/Inst.:	IPP - Intermountain Power Project	Facility No:	S1430
Bldg No./Sec:	9BSE-G 9BSEGO	Bldg Name:	General Services
Bldg Use:	Maintenance	Inspection Date:	May/2001
Membrane:	BUR: Asphalt	Area (SF):	8156
Surfacing:	AGG: Pea Gravel	Age (Yrs):	16
Vapor Ret:	UNKNOWN	Deck Type:	STEEL
Insulation:	EXPANDED POLYSTYRENE	Est. Repair Cost:	$ 3443.00

CORRECTIVE ACTION RECOMMENDED: Maintenance, Repair and/or Partial Replacement

JUSTIFICATION: An economic analysis of the roof condition, including age, indicates that it is more cost effective to accomplish the necessary maintenance, repairs and/or partial replacement of the roofing components rather than replace the roofing system. Therefore, accomplish the following actions for the above roof section.

[Note: numbers refer to identification numbers of distresses corresponding with the Roof Inspection Worksheet]

3.	BF-M-2 512 LF	Prime exposed and deteriorated base flashing and coat with heavy bodied asphalt coating. [3]
4.	BF-H-1 4 LF	Repair damaged base flashing by overlaying each localized defect with new base flashing. [4]
5.	DR-M-1 2	Prime and coat surface of roof drains having exposed stripping felts with heavy bodied asphalt coating. [5]
6.	DR-H-3 3	Remove foreign material clogging roof drains. [6]
7.	SR-M-1 10 SF	Reinstall aggregate on exposed membrane surfaces. [7]
9.	MC-M-2 10 LF	Reseal failed joints in metal coping cap and reattach. [9]

Economic Evaluation Worksheet for a Built-Up Roofing System

Agency/Inst: IPP - Intermountain Power Project | Building/Section: 9BSE-G 9BSEGO | Area: 8156 SF | Age: 16

Flashing

DIS-SL-DF	Unit Cost	Qty	Total Cost
BF-H-1	23.37	4	$ 93.48
BF-H-2	9.97		
BF-H-3	30.69		
BF-M-1	4.72		
BF-M-2	4.78	512	$ 2447.36
BF-M-3	5.88		
BF-M-4	19.03		
DR-H-1	27.51		
DR-H-2	51.45		
DR-H-3	47.43	3	$ 142.29
DR-H-4	102.21		
DR-M-1	21.98	2	$ 43.96
DR-M-2	34.20		
DR-M-3	19.54		
EM-H-1	6.63		
EM-H-2	8.56		
EM-H-3	14.60		
EM-H-4	7.63		
EM-H-5	21.16		
EM-M-2	6.46		
EM-M-3	6.68		
EM-M-4	6.80		
FP-H-1	16.82		
FP-H-2	47.26		
FP-H-3	82.84		
FP-H-4	22.88		
FP-M-1	4.81		
FP-M-2	5.78		
FP-M-3	31.07		
FP-M-4	19.54		
MC-H-1	9.50		
MC-H-2	9.44		
MC-H-3	5.37		
MC-M-1	15.41		
MC-M-2	18.19	10	$ 181.90
MC-M-3	8.11		
MC-M-4	4.00		
MC-M-5	6.63		
PP-H-1	19.54		
PP-H-2	37.47		
PP-H-3	21.98		
PP-H-4	51.69		

DIS-SL-DF	Unit Cost	Qty	Total Cost

Insulation: 0.00 NONE

Repair SetUp Charge = $ 514

IP12_004414

Maintenance, Repair & Replacement Analysis

Building: 9BSE-G - General Services
Section: 9BSEGP
Section Area: 7950

Area Cost Index: $1.00
Roof Replacement Cost: $5.25 per SF
Insulation Replacement Cost: $8.00 per SF

Originally Constructed/Last Replaced: 1985
Current Age: 16 Year(s)

Visual Inspection Date: 5/17/2001
Insulation Inspection Date: --------

Predicted Year of Replacement (w/o repairs): 2006
Additional Service Life (w/repairs): 6 Year(s)
Predicted Year of Replacement (w/repairs): 2012

					Current	Improved
				ICI	100	100
				FCI	44	80
Cost for Repairs:	$ 3377.00	562.83	$/year	MCI	100	100
Cost for Replacement:	$ 41737.50	2087.00	$/year	RCI	61	86

Adjusted Repair/Replace Ratio = 0.43

Recommendation: Repair

IP12_004415

Generated: Jul/13/2001

Corrective Action Requirement Sheet

Major Repair

(Note: Attach a copy of this form, along with a copy of the Roof Inspection Worksheet to DA Form 4283

Agency/Inst.:	IPP - Intermountain Power Project	Facility No:	S1430
Bldg No./Sec:	9BSE-G 9BSEGP	Bldg Name:	General Services
Bldg Use:	Maintenance	Inspection Date:	May/2001
Membrane:	BUR: Asphalt	Area (SF):	7950
Surfacing:	AGG: Pea Gravel	Age (Yrs):	16
Vapor Ret:	UNKNOWN	Deck Type:	None
Insulation:	EXPANDED POLYSTYRENE	Est. Repair Cost:	$ 3377.00

CORRECTIVE ACTION RECOMMENDED: Maintenance, Repair and/or Partial Replacement

JUSTIFICATION: An economic analysis of the roof condition, including age, indicates that it is more cost effective to accomplish the necessary maintenance, repairs and/or partial replacement of the roofing components rather than replace the roofing system. Therefore, accomplish the following actions for the above roof section.

[Note: numbers refer to identification numbers of distresses corresponding with the Roof Inspection Worksheet]

3.	BF-M-2 466 LF	Prime exposed and deteriorated base flashing and coat with heavy bodied asphalt coating. [3]
4.	BF-H-1 9 LF	Repair damaged base flashing by overlaying each localized defect with new base flashing. [4]
5.	DR-M-1 3	Prime and coat surface of roof drains having exposed stripping felts with heavy bodied asphalt coating. [5]
6.	DR-H-3 2	Remove foreign material clogging roof drains. [6]
7.	MC-M-2 10 LF	Reseal failed joints in metal coping cap and reattach. [7]
8.	FP-H-3 1	Install missing flashing sleeves on flashed penetrations. [8]

Economic Evaluation Worksheet for a Built-Up Roofing System

Agency/Inst: IPP - Intermountain Power Project | Building/Section: 9BSE-G 9BSEGP | Area: 7950 SF | Age: 16

Flashing

DIS-SL-DF	Unit Cost	Qty	Total Cost
BF-H-1	23.37	9	$ 210.33
BF-H-2	9.97		
BF-H-3	30.69		
BF-M-1	4.72		
BF-M-2	4.78	466	$ 2227.48
BF-M-3	5.88		
BF-M-4	19.03		
DR-H-1	27.51		
DR-H-2	51.45		
DR-H-3	47.43	2	$ 94.86
DR-H-4	102.21		
DR-M-1	21.98	3	$ 65.94
DR-M-2	34.20		
DR-M-3	19.54		
EM-H-1	6.63		
EM-H-2	8.56		
EM-H-3	14.60		
EM-H-4	7.63		
EM-H-5	21.16		
EM-M-2	6.46		
EM-M-3	6.68		
EM-M-4	6.80		
FP-H-1	16.82		
FP-H-2	47.26		
FP-H-3	82.84	1	$ 82.84
FP-H-4	22.88		
FP-M-1	4.81		
FP-M-2	5.78		
FP-M-3	31.07		
FP-M-4	19.54		
MC-H-1	9.50		
MC-H-2	9.44		
MC-H-3	5.37		
MC-M-1	15.41		
MC-M-2	18.19	10	$ 181.90
MC-M-3	8.11		
MC-M-4	4.00		
MC-M-5	6.63		
PP-H-1	19.54		
PP-H-2	37.47		
PP-H-3	21.98		
PP-H-4	51.69		

DIS-SL-DF	Unit Cost	Qty	Total Cost

Insulation: 0.00 NONE

Repair SetUp Charge = $ 514

IP12_004417

Maintenance, Repair & Replacement Analysis

Building:	9BSE-G - General Services	Area Cost Index:	$1.00
Section:	9BSEGQ	Roof Replacement Cost:	$5.25 per SF
Section Area:	7950	Insulation Replacement Cost:	$8.00 per SF

Originally Constructed/Last Replaced:	1985	Visual Inspection Date:	5/17/2001
Current Age:	16 Year(s)	Insulation Inspection Date:	--------

Predicted Year of Replacement (w/o repairs):			2005				
Additional Service Life (w/repairs):			7	Year(s)		Current	Improved
Predicted Year of Replacement (w/repairs):			2012		ICI	100	100
					FCI	42	80
Cost for Repairs:	$	3113.00	444.71	$/year	MCI	92	100
Cost for Replacement:	$	41737.50	2087.00	$/year	RCI	58	86

Adjusted Repair/Replace Ratio = 0.37 Recommendation: Repair

IP12_004418

Generated: Jul/13/2001

Corrective Action Requirement Sheet

Major Repair

(Note: Attach a copy of this form, along with a copy of the Roof Inspection Worksheet to DA Form 4283

Agency/Inst.:	IPP - Intermountain Power Project	Facility No:	S1430
Bldg No./Sec:	9BSE-G 9BSEGQ	Bldg Name:	General Services
Bldg Use:	Maintenance	Inspection Date:	May/2001
Membrane:	BUR: Asphalt	Area (SF):	7950
Surfacing:	AGG: Slag	Age (Yrs):	16
Vapor Ret:	UNKNOWN	Deck Type:	STEEL
Insulation:	EXPANDED POLYSTYRENE	Est. Repair Cost:	$ 3113.00

CORRECTIVE ACTION RECOMMENDED: Maintenance, Repair and/or Partial Replacement

JUSTIFICATION: An economic analysis of the roof condition, including age, indicates that it is more cost effective to accomplish the necessary maintenance, repairs and/or partial replacement of the roofing components rather than replace the roofing system. Therefore, accomplish the following actions for the above roof section.

[Note: numbers refer to identification numbers of distresses corresponding with the Roof Inspection Worksheet]

3.	BF-M-2 480 LF	Prime exposed and deteriorated base flashing and coat with heavy bodied asphalt coating. [3]
4.	BF-H-1 2 LF	Repair damaged base flashing by overlaying each localized defect with new base flashing. [4]
5.	SR-M-1 24 SF	Reinstall aggregate on exposed membrane surfaces. [5]
6.	DR-M-1 3	Prime and coat surface of roof drains having exposed stripping felts with heavy bodied asphalt coating. [6]
7.	DR-H-3 3	Remove foreign material clogging roof drains. [7]

Economic Evaluation Worksheet for a Built-Up Roofing System

Agency/Inst: IPP - Intermountain Power Project | Building/Section: 9BSE-G 9BSEGQ | Area: 7950 SF | Age: 16

Flashing

DIS-SL-DF	Unit Cost	Qty	Total Cost
BF-H-1	23.37	2	$ 46.74
BF-H-2	9.97		
BF-H-3	30.69		
BF-M-1	4.72		
BF-M-2	4.78	480	$ 2294.40
BF-M-3	5.88		
BF-M-4	19.03		
DR-H-1	27.51		
DR-H-2	51.45		
DR-H-3	47.43	3	$ 142.29
DR-H-4	102.21		
DR-M-1	21.98	3	$ 65.94
DR-M-2	34.20		
DR-M-3	19.54		
EM-H-1	6.63		
EM-H-2	8.56		
EM-H-3	14.60		
EM-H-4	7.63		
EM-H-5	21.16		
EM-M-2	6.46		
EM-M-3	6.68		
EM-M-4	6.80		
FP-H-1	16.82		
FP-H-2	47.26		
FP-H-3	82.84		
FP-H-4	22.88		
FP-M-1	4.81		
FP-M-2	5.78		
FP-M-3	31.07		
FP-M-4	19.54		
MC-H-1	9.50		
MC-H-2	9.44		
MC-H-3	5.37		
MC-M-1	15.41		
MC-M-2	18.19		
MC-M-3	8.11		
MC-M-4	4.00		
MC-M-5	6.63		
PP-H-1	19.54		
PP-H-2	37.47		
PP-H-3	21.98		
PP-H-4	51.69		

DIS-SL-DF	Unit Cost	Qty	Total Cost

Insulation: 0.00 NONE

Repair SetUp Charge = $ 514

IP12_004420

Maintenance, Repair & Replacement Analysis

Building:	9BSE-G - General Services	Area Cost Index:	$1.00
Section:	9BSEGR	Roof Replacement Cost:	$5.25 per SF
Section Area:	2650	Insulation Replacement Cost:	$8.00 per SF

Originally Constructed/Last Replaced:	1985	Visual Inspection Date:	5/17/2001
Current Age:	16 Year(s)	Insulation Inspection Date:	--------

Predicted Year of Replacement (w/o repairs):			2006				
Additional Service Life (w/repairs):			6	Year(s)		Current	Improved
Predicted Year of Replacement (w/repairs):			2012		ICI	100	100
					FCI	45	80
Cost for Repairs:	$	1875.00	312.50	$/year	MCI	90	100
Cost for Replacement:	$	13912.50	696.00	$/year	RCI	60	86

Adjusted Repair/Replace Ratio = 0.61 Recommendation: Repair

Generated: Jul/13/2001

Corrective Action Requirement Sheet

Major Repair

(Note: Attach a copy of this form, along with a copy of the Roof Inspection Worksheet to DA Form 4283

Agency/Inst.:	IPP - Intermountain Power Project	Facility No:	S1430
Bldg No./Sec:	9BSE-G 9BSEGR	Bldg Name:	General Services
Bldg Use:	Maintenance	Inspection Date:	May/2001
Membrane:	BUR: Asphalt	Area (SF):	2650
Surfacing:	AGG: Pea Gravel	Age (Yrs):	16
Vapor Ret:	UNKNOWN	Deck Type:	STEEL
Insulation:	EXPANDED POLYSTYRENE	Est. Repair Cost:	$ 1875.00

CORRECTIVE ACTION RECOMMENDED: Maintenance, Repair and/or Partial Replacement

JUSTIFICATION: An economic analysis of the roof condition, including age, indicates that it is more cost effective to accomplish the necessary maintenance, repairs and/or partial replacement of the roofing components rather than replace the roofing system. Therefore, accomplish the following actions for the above roof section.

[Note: numbers refer to identification numbers of distresses corresponding with the Roof Inspection Worksheet]

2.	BF-M-2 240 LF	Prime exposed and deteriorated base flashing and coat with heavy bodied asphalt coating. [2]
3.	SR-M-1 20 SF	Reinstall aggregate on exposed membrane surfaces. [3]
5.	MC-M-2 5 LF	Reseal failed joints in metal coping cap and reattach. [5]
6.	DR-M-2 1	Install new drain strainers where broken or missing. [6]
7.	DR-H-3 1	Remove foreign material clogging roof drains. [7]

Economic Evaluation Worksheet for a Built-Up Roofing System

Agency/Inst: IPP - Intermountain Power Project | Building/Section: 9BSE-G 9BSEGR | Area: 2650 SF | Age: 16

Flashing

DIS-SL-DF	Unit Cost	Qty	Total Cost
BF-H-1	23.37		
BF-H-2	9.97		
BF-H-3	30.69		
BF-M-1	4.72		
BF-M-2	4.78	240	$ 1147.20
BF-M-3	5.88		
BF-M-4	19.03		
DR-H-1	27.51		
DR-H-2	51.45		
DR-H-3	47.43	1	$ 47.43
DR-H-4	102.21		
DR-M-1	21.98		
DR-M-2	34.20	1	$ 34.20
DR-M-3	19.54		
EM-H-1	6.63		
EM-H-2	8.56		
EM-H-3	14.60		
EM-H-4	7.63		
EM-H-5	21.16		
EM-M-2	6.46		
EM-M-3	6.68		
EM-M-4	6.80		
FP-H-1	16.82		
FP-H-2	47.26		
FP-H-3	82.84		
FP-H-4	22.88		
FP-M-1	4.81		
FP-M-2	5.78		
FP-M-3	31.07		
FP-M-4	19.54		
MC-H-1	9.50		
MC-H-2	9.44		
MC-H-3	5.37		
MC-M-1	15.41		
MC-M-2	18.19	5	$ 90.95
MC-M-3	8.11		
MC-M-4	4.00		
MC-M-5	6.63		
PP-H-1	19.54		
PP-H-2	37.47		
PP-H-3	21.98		
PP-H-4	51.69		

DIS-SL-DF	Unit Cost	Qty	Total Cost

Insulation: 0.00 NONE

Repair SetUp Charge = $ 514

IP12_004423

(925) 363-5917
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http://www.kta.com

KTA-TATOR, INC.
3523 Halfmoon Lane, Concord, CA 94518

INTRODUCTION

On April 10, 2008 Intermountain Power contracted with KTA-Tator, Inc. (KTA) to determine the cause of delaminations and blistering that was occurring on a carbon fiber reinforced lining that had been installed on large diameter cooling piping in Unit 2 at the Delta, UT power plant. The KPFF lining had been applied to numerous areas within the piping system over the last three years. During the 2008 spring Unit 2 outage large areas of the coating were found to be blistered and delaminated. Mr. Ray Tombaugh, Senior Consultant, was responsible for performing the investigation and preparing this report.

SUMMARY

There is widespread coating delamination and poor coating adhesion found throughout the piping in the Unit 2 cooling water system at the Intermountain Power Station in Delta UT. In this Unit, failure is primarily occurring between the KPFF ARC topcoats and the underlying Cabosil filled epoxy coating. To a lesser extent there are failures between layers of Cabosil filled material. These failures are primarily restricted to the fabric seam areas where an overcoat of Cabosil filled material is applied to the saturated fabric.

The cause of the failure is the formation of amine deposits (amine blush) on and in the Cabosil filled material and the ARC coating. Typically cool, damp conditions are required to cause amine blush – conditions that differ from the temperatures and humidity readings that were reported during the 2006 application. However, testing has shown that both materials will blush at laboratory conditions of 70 F and 50% humidity. Laboratory testing has also shown that the materials applied in the field were mixed at ratios consistent with the KPFF instructions. There is an inherent problem with the coating formulations since even undercatalyzed mixes (amine deficient) will blush at ideal application conditions.

Based on the field and laboratory investigation it is likely that additional failures will occur. The failures are likely to occur (1) within the same plane of failure (between ARC and Cabosil filled material) but (2) may also extend to other planes of failure, such as between layers of saturated fabric or between the primer and fabric layers. Additional destructive testing would be required in order to ascertain the extent of future failure. The testing would include comprehensive field adhesion testing and the removal of core samples of the material for laboratory investigation.

BACKGROUND

The following information was provided by Dahl Dalton and Jerry Hintze of Intermountain Power. The power plant was constructed in 1985 with several thousand feet of buried, concrete-lined, pre-stressed, steel cooling water piping. The piping ranges in size from 7' to 10' in diameter. The majority of the piping is 10' in diameter.

Some years after the plant became operational, breaches in the piping occurred. The piping was excavated at several areas and inspections determined that the strengthening rods had corroded. An engineering evaluation determined that the necessary loss in strength (from the corroded rods) could be regained by the application of a reinforced carbon fiber system to the interior of the pipe. A KPFF system was selected based upon its successful performance at the Palo Verdes nuclear plant.

The initial applications of the KPFF system were installed on Unit 1 in 2005. Additional applications were performed in 2007. Lining work began on Unit 2 and 2006 and then was reinitiated during the current 2008 outage. There are no product data sheets published for the material. Instruction sheets have been given to Intermountain Power.

The concrete surface is abrasive blasted to impart a profile. Any cracks that are present are repaired.

The coating system consists of the following layers:

1. A two component epoxy primer PRI 2002-3-R-A / PRI 2000-5-HR-B (Layer 1) is spray-applied directly to the concrete.

2. The same epoxy is mixed with Cabosil (Epoxy Protective Coating) and then trowel applied over the primer (Layer 2).

3. Into Layer 2 is placed the carbon fiber fabric that has been saturated on both sides with the Cabosil filled epoxy (Layer 3).

4. Over the fabric is applied another layer of Cabosil filled epoxy (Layer 4).

5. A second layer of saturated fabric is applied (Layer 5).

6. In Unit 1, a Cabosil filled layer (layer 6) was applied over the second fabric layer. However, after failures were observed in that unit, it was decided to eliminate that second Cabosil layer.

7. Currently, only the edges of the fabric are tapered smooth with additional Cabosil filled

epoxy (Layer 7) and one coat of primer (PRI 2002-3-R-A / PRI 2000-5-HR-B) was applied to the entire surface.

8. Over the system described above are applied two coats of Applied Resistive Coating (ARC) PRI C-R-A / 2001 C-H-B (Layers 8 and 9).

In 2007, the first entry into the Unit 1 piping after the initial application, coating failures in the form of delaminations were observed. Failures occurred between the saturated carbon fiber and the Cabosil filled epoxy layer. At that time it was decided by KPFF to omit the final Cabosil filled epoxy layer (Layer 6). In 2008 the failures are most prominent between the ARC coats and the underlying Cabosil filled epoxy coat.

There are no dry film thicknesses reported for any of the layers. Original KPFF instructions were to apply the Cabosil filled epoxy at ¼" wet film thickness (WFT). However, the contractor had difficulty in hanging that thickness and so instructions were revised to apply it at 1/8" thick WFT.

During the initial applications, the recoat window for the PRI 2002-3-R-A / PRI 2000-5-HR-B was reported to be 3 weeks. During the 2008 application it was revised to 24 hours. However, overcoating was frequently performed within only a few hours.

The material safety data sheets report both epoxies as modified aliphatic polyamines.

The materials are shipped to the site in 200 gallon carboys and then dispensed by aliquots into a bucket which in turn is poured into a measuring bucket that has a piece of tape at the proper level for the specific quantity of material needed for one batch. The measured quantities of both components are poured into a clean bucket and mixed for a specific period of time.

The instruction sheets for the coating materials report the following volumetric mix ratios:

Primer, Saturating Resin, Epoxy Protective Coating (Layer 1): 4.06:1

Epoxy Bonding Agent (Layers 2 through 7) - Saturating Resin to Cabosil: 1:1.25

Applied Resistive Coating: 3.34:1

The instructions for mixing the Cabosil filled epoxy report that once mixed the coating should be separated into smaller volumes to increase the pot life. The instructions for mixing the ARC report that it is to be mixed for exactly 2 minutes. If mixed using a high shear mixing blade, it is to be performed at low speed. The mix times were strictly enforced by KPFF.

The instructions report the following recoat windows:

- Cabosil filled material over itself - 55 F: 24 hours, 72 F: 16 hours, 85 F: 2 hours.
- ARC over PRI Cabosil filled material – Same as Above
- ARC over itself - 55 F: 48 hours, 72 F: 36 hours, 85 F: 24 hours

The NSF certification reports that the recoat window is 4 hours at 72 F.

Temperature/humidity logs were kept by the contractor and are appended to the report. Temperatures in the pipe ranged from 55 F to 82 F with most readings in the 65 to 75 degree range. Humidity ranged from 15% to 44% with most of the readings between 20% and 30%.

Adhesion testing was performed by Corrpro in 2006 and 2008 using a hydraulic adhesion tester in accordance with ASTM D 4541, "Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers." A complete copy of the test data is attached to the report. The following is a summary:

- Testing performed in 2006 showed that adhesion failures generally occurred at less than 700 psi (64% of the tests) with the failure plane between the first ARC coat and the primer or between the primer and the fabric. In a few cases failure occurred between the layers of carbon fabric.
- A second set of tests was performed in 2008 on the failing 2006 coating. The dollies were applied to the ARC coating applied over the primed carbon fiber. Failures almost always occurred between the ARC coating and the primer applied directly to the fabric. Seventy-five percent of the failures (15 out of 20) occurred at less than 500 psi.
- A third set of testing was performed in 2008 along the fabric seams. Eighty-three percent of the tests (5 out of 6) failed at less than 556 psi. The plane of failure was between the first coat of the ARC and the primer applied over the seam.
- Testing performed in 2008 on material that was applied in 2008 resulted in significantly different results. Testing was performed at two different locations. Location 1 had two primer coats applied over the Cabosil coat and the underlying two layers of fabric. Location 2 had two coats of ARC over one coat of primer applied to the underlying fabric.

    a) Testing performed at Location 1 resulted in excellent coating adhesion with 83% (15 out of 18) of tests greater than 1000 psi. Failures occurred between the two prime coats.

b) At Location 2 one test resulted in a 1053 psi tensile adhesion and the second test resulted in a 557 psi value. In both cases failures occurred between the first ARC coat and the primer.

Copies of the referenced documents are included in Attachment A, Background Information.

RESULTS OF THE FIELD INVESTIGATION

The field investigation was performed on April 11, 2008 and consisted of visual assessments and adhesion tests, blister assessments and pH measurements.

Adhesion was assessed in accordance with ASTM D6677, "Standard Test Method for Measuring Adhesion by Knife". ASTM D6677 involves making an X-scribe in the paint film. The knifepoint is then inserted at the intersection of the two scribes and lifted. Adhesion is rated on the extent of coating removed on an even number scale of 0 to 10, with 10 being the best.

Blistering was evaluated in accordance with ASTM D714, "Standard Test Method for Evaluating Degree of Blistering of Paints". The standard evaluates blistering on the basis of frequency (few, medium, medium dense and dense) and size (even numbers 2 through 8 with 8 being the smallest). Visual standards are provided for comparison to field conditions.

The pH was measured by applying pH paper to a newly opened blister that contained fluid.

Detailed assessment data is provided in Table 1. The following is a summary of the field investigation results:

1. The ARC coating had delaminated from approximately 20% of the lined pipe surfaces.

2. Approximately 80% of the surfaces with ARC coating in place were blistered. The blisters ranged in size from ½" to 3/4' in diameter and were filled with water.

3. The blisters appear to have pinholes in them with brown viscous material seeping out.

4. The pH of the blister fluid was 11. The blister fluid had a paint odor.

5. Adhesion was poor between the ARC coats and the underlying Cabosil filled epoxy (ASTM D6677: 0).

6. Adhesion between the layers of Cabosil filled material varied :

   - Adhesion was generally poor on the seam (ASTM D6677: 0). When forcibly

disbonded the failure occurred between a Cabosil filled epoxy coat and the underlying saturated fabric.

- Adhesion varied in the field of the fabric (ASTM D6677: 0-10). When the coating was forcibly disbonded in mid-sheet the underlying fabric did not appear saturated.

Photos documenting both conditions are included in Attachment B, Photo Summary.

SAMPLES

KTA-1: Cabosil filled layer with ARC topcoat delaminated from saturated fabric.

KTA-3: ARC topcoat(s) with brown staining.

KTA-4: Vial of blister fluid.

KTA-6: ARC topcoats.

KTA-7: Yellowed Cabosil filled material.

KTA-8: Large delamination from Cabosil filled material with Cabosil layer and ARC layer at seam.

KTA-9: ARC delaminations away from seam.

SUMMARY OF THE LABORATORY INVESTIGATION

A complete copy of the laboratory investigation is included in Attachment C, Laboratory Investigation. The following is a summary:

1. The white Cabosil filled coat ranged from approximately 18 mils 80 mils.

2. Two to three gray ARC coats were observed on each of the samples evaluated. The total dry film thickness of the ARC layer varied significantly.

   - Two samples (KTA-8 and KTA-9) ranged between 8.6 and 22.5 mils.
   - Three samples (KTA-1, KTA-3 and KTA-6) ranged between 18.2 and 53.4 mils.

3. Coating adhesion was subjectively assessed on sample KTA-1 (ARC applied to Cabosil layer) and was found to be poor. (The other samples did not contain the two layers so adhesion tests were not performed).

4. Microscopic examination of the ARC coat samples (KTA-1, KTA-3 and KTA-6, KTA-8 and KTA-9) showed craters in the top surface of the ARC-coat. The craters were similar in appearance to when solvent is released just prior to cure.

5. There was a brown sticky residue on all of the coating samples (both Cabosil filled coating and ARC coating).

6. The backs of the Cabosil filled samples had the impression of woven fabric.

7. Chemical analysis of blister liquid and the sticky brown deposits determined that the material was consistent with an amine.

8. Control samples of the ARC coating were mixed (1) in accordance with the manufacturers stated mix ratio, (2) using less catalyst then required (low amine concentrations) and (3) using more catalyst then required (high amine concentrations). Chemical analysis of the topcoat from samples KTA-1 and KTA-6 determined each to be an epoxy and consistent in formulation with the properly mixed control sample of the ARC. However, there was an abundance of amine found in the field samples when compared against the amine concentrations in the properly mixed laboratory sample.

9. Control samples of the Cabosil filled coating were mixed (1) in accordance with the manufacturers stated mix ratio, (2) using less catalyst then required (low amine concentrations) and (3) using more catalyst then required (high amine concentrations). Chemical analysis of the Cabosil layer from samples KTA-1, KTA-7 and KTA-8 determined each to be an epoxy and consistent in formulation with the properly mixed control sample of the Cabosil filled coating. However, there was an abundance of amine found in field sample KTA-7 when compared against the amine concentrations in the properly mixed laboratory sample. Only a small amount of amine was found in samples KTA-1 and KTA-8. Elevated moisture levels were found in these samples.

10. Samples of the Cabosil filled coatings and the ARC coatings, mixed at various ratios were allowed to age under various temperatures and humidity:

    - The Cabosil filled coating mixed at the specified ratio, amine blushed at 50-100% humidity, and 55-113F.

    - The ARC coating amine blushed at the correct mix ratio as well as the over -catalyzed version at ambient conditions and under humid cool conditions. The under- catalyzed ARC coating did not amine blush at ambient conditions.

11. One control sample of properly mixed Cabosil filled material that was analyzed directly after

cure was allowed to age in the laboratory and then reanalyzed. After one month, the amount of amine present of the surface increased when compared to the original chemical analysis. In addition, the amount of bound moisture present in the control sample also increased.

12. Test panels, abrasive blasted to achieve a profile of 2 to 3 mils, were primed with a Cabosil filled layer applied at $^1/_8$" wet film thickness. Twenty-four hours later the panels were recoated with either another layer of the Cabosil filled coat or a layer of Applied Resistive Coating (ARC) topcoat. The panels were then allowed to cure at various temperatures and humidity. Tensile adhesion (pull-off strength) testing was performed on the cured test panels.

    - Adhesion testing of the Cabosil to Cabosil panels showed that adhesion decreased as a function of decreasing temperature at moderate humidity.

    - Adhesion testing of the ARC Coating to Cabosil remained consistent at all of the temperatures and humidities tested.

DISCUSSION

There is widespread blistering and subsequent coating delamination found on the lined cooling water piping in Unit 2 at the Intermountain Power Station in Delta, UT. The blistering and delaminations occurred primarily between the the ARC topcoats and the underlying Cabosil layer. The problem is widespread in that:

- The topcoat has already delaminated from approximately 20% of the coated pipe surfaces.
- Approximately 80% of all surfaces are blistered.
- All ARC-coated areas tested were poorly bonded.

To a lesser extent, delaminations and poor coating adhesion were observed between layers of Cabosil filled material. The failures and poor coating adhesion were located primarily along the fabric joints where additional Cabosil filled material was applied to the saturated fabric. In a few locations failures were found within the fields of the fabric. Forced removal of the coating exposed unsaturated fabric in these locations.

The blistering and poor coating adhesion between the layers of Cabosil filled material and between the ARC coating and the Cabosil filled material is a result of the formation of amines (amine blush) on the surface of the Cabosil material and throughout the cross section of the ARC coating. This is exemplified by the following field observations that were found throughout the lined pipe at Intermountain Power:

1. Amber colored blister fluid with a pH of 11.

2. Sticky brown sappy material deposited on the surface of the ARC coating.
3. Amber stained Cabosil filled material.

Typically, amine blush occurs when amine cured epoxies cure under cool, high humidity conditions. The amine portion of the coating separates as an oily film or droplets, often amber in color. The amine component reacts with moisture and atmospheric carbon dioxide to form ammonium bicarbonate and/or ammonium carbamate.

There are additional environmental conditions that can exacerbate the formation of amine blush. These include elevated carbon dioxide moisture levels. The amine compounds are often hygroscopic (absorb moisture) and are very efficient scavengers of carbon dioxide from the air. In confined spaces with human activity, such as in the pipe at the Intermountain Power Station, carbon dioxide concentrations can increase 2 to 3 times that normally found in the atmosphere. In the presence of gas burning heaters, the carbon dioxide concentrations could be even greater. These sources of heat may also produce abundant quantities of water vapor resulting is exacerbated blushing problems. It was reported that gas heaters were used to elevate the temperature in the pipe and so elevated carbon dioxide levels were likely. It is important to note that the humidity readings suggest that moisture levels were not elevated. Humidity between 20% and 30% were common in the pipe. Under these conditions amine blush is not expected.

As reported above, typically cool, high humidity conditions are required for the amine cured epoxies to blush. However, both of the coatings used at Intermountain power were found to blush even under moderate temperature and low humidity conditions (70 F and 50% humidity) in the KTA laboratory. Several laboratory tests were used to reach this conclusion:

1. Samples of the Cabosil filled coatings and the ARC coatings were mixed at the recommended ratios in the laboratory and were allowed to age under various temperatures and humidity. Both the Cabosil filled coating and the ARC coating blushed even at 50% humidity and 70 F (ambient conditions).

2. The Cabosil filled coating blushed even when it was mixed with deficient quantities of catalyst (amine).

3. The surface of a sample of Cabosil filled coating was analyzed directly after cure and then reanalyzed after one month. The amount of amine present on the surface increased when compared to the original chemical analysis.

4. Adhesion testing showed that there were significant reductions in adhesion between two layers of Cabosil filled material as temperature decreased under moderately humid conditions.

The adhesion testing performed by Corrpro also indicates that there are adhesion issues. Testing performed in 2006 clearly resulted in poor adhesion values. Using the hydraulic adhesion tester that was reported to have been used, adhesion tests greater than 1000 psi should have resulted. Furthermore the primary plane of failure (between the first ARC coat and the primer) is consistent with the results of the laboratory analysis. The primer resin is prone to blush even under ideal conditions resulting in a weak bond. The testing performed in 2008 on the 2006 applications is consistent with the above findings.

The testing performed on the 2008 applications was remarkably different. The testing resulted in 83% (15 out of 18) of tests greater than 1000 psi. Failures occurred between the two prime coats. While these test results are excellent there is still concern that retests performed at the next outage may result in different results. KTA bases this conclusion on the fact that the primer resin continues to form amine blush even after it has cured. Blushing could likely result in reduced coating adhesion over time.

Clearly amine blush should not form under laboratory conditions and in the even drier conditions down in the pipe unless there is a formulation problem with the coating. Laboratory testing showed that the samples of coating removed from the pipe were mixed consistent with the manufacturers recommended instructions.

The amine blush formation at Intermountain Power is not a result of mis-mixing where too much catalyst (amine component) is added to the coating. In fact, laboratory testing showed that the Cabosil filled coating blushed when the mix was deficient in amine (under catalyzed) and continued to blush long after the cure period. As a result of this finding and the relatively quick succession in which layers were applied it is doubtful that the blush was visible at the time of application.

This propensity to blush is also the likely cause of the tiny craters in the ARC coating. As discussed above the amines are water loving and will draw moisture in from the air. When the moist amine surfaces are overcoated, the moisture tries to escape, however, the coating cures before it is fully released - a crater results. This process also explains the reason that bound moisture was found in the coating.

It is important to note that there are a number of areas within the Unit 2 piping where the coating has delaminated from fabric that was not saturated. In these areas the ARC coating never bonded properly to the fabric and delaminations resulted. The area with unsaturated fabric is relatively small.

RECOMMENDATIONS

It is very likely that the remaining ARC coatings will continue to delaminate from the surface of the Cabosil filled material. Similarly the Cabosil filled material is likely to delaminate. While KTA

has not inspected Unit 1 where there are many square feet of surface with Cabosil filled applications applied over saturated fabric, it is likely that delaminations will continue to occur as well. Furthermore since both coatings (ARC and Cabosil filled) have an inherent problem in the formulation that results in separation between layers, KTA cannot assure Intermountain Power that there will not be separation between the primer and the first fabric layer or between the two layers of saturated fabric.

Additional testing will be necessary in order to assess whether the coating will remain in place. This would include field adhesion testing and additional laboratory testing where sections of the pipe wall (cement and lining) would be examined.

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CORROSION CONTROL

INVESTIGATION AND DESIGN

PHASE I REPORT

INTERMOUNTAIN POWER SERVICE CORPORATION
DELTA, UTAH

APRIL, 2005

Table of Contents

Appendices

1.0 Introduction

Corrpro Companies Inc. conducted field testing services for the corrosion investigation and control at the Intermountain Power Project in the two (2) week period from March 14 through March 26, 2005. The primary purpose was to collect electrical continuity test data on the circulating water pipelines and to participate in the Unit #1 condenser water box inspection. An initial inspection of the cathodic protection systems associated with the Unit #2 condenser water box was also conducted. The cathodic protection system associated with the six (6) steel circulating water supply pipelines at the circulating water pump house was inspected and adjusted for optimum performance.

This report discusses each structure included in the overall evaluation of the Intermountain Power Project and provides recommendations necessary for the proper operation of the cathodic protections systems associated with the condenser water box units. The results of the electrical continuity tests conducted on the pre-stressed concrete cylinder supply and return piping are discussed and requirements to provide further electrical continuity bonding to the pipelines for cathodic protection design purposes are presented.

2.0 Results and Conclusions

2.1 Electrical Continuity of PCC Pipe

The results of the electrical continuity tests indicate that each of the unit 1 and unit 2 supply and return pre-stressed concrete cylinder pipelines (PCCP) are discontinuous within themselves and between each of the four pipelines.

The tests are conducted by inducing DC current from a temporary test arrangement onto each pipeline and observing the "on / off" shift in potential at various contact points to the pipeline along the pipeline route. The existing cathodic protection system located at the circulating water pump house was used for these tests. The negative cable to the circulating water pipelines was temporarily disconnected and then connected to the PCCP under test. An electronic current interrupter was placed into the circuit to provide a timed "On / Off" cycling of the DC power source.

The electrical continuity test is performed by using a copper sulfate reference cell (half cell) that is placed directly above the pipeline under test and in a stationary position throughout the test. An "On/Off " potential measurement is recorded on the pipe at the stationary electrode and is used as a "Base Value" for comparison purposes. A small gauge wire hand reel is then connected to the stationary reference electrode and used as a positive lead wire extension of the voltmeter and additional "On/Off " potential measurements are recorded at all accessible points of contact to the pipeline along the pipelineroute.

Electrical continuity is established between sections of pipeline under test when the base On/Off value as recorded at the stationary reference electrode is duplicated at the other voltmeter / negative connections made at contact points to the pipeline along the alignment. Connections to the pipeline could only be made at the manholes along the pipeline and at the supply pipeline risers at the pump house.

Electrical discontinuity is demonstrated when there is a positive shift in the potential measurement observed with the test current applied ("On"), i.e. the "On" potential is more positive than the "Off" potential measurement.

Electrical discontinuity is also indicated when the base On/Off value is not duplicated at each subsequent test location, or where there is no shift in potential observed at a test location.

Refer to data table A1 to A6 for the results of the tests for each pipeline. The following table summarizes the results of the electrical continuity tests conducted on the PCCP supply and return lines.

Table 1
Electrical Continuity Test Results

PCC Pipe	From	To	Results
Unit 1 Supply	MH-1 AA at Tent 2	Supply Pipe at Pump House	Positive shift in potential - pipeline is discontinuous
Unit 1 Supply	MH-1 AA at Tent 2	MH-1AA at Condenser building	Positive shift in potential - pipeline is discontinuous
Unit 1 Return	MH-2A at Tent 2	MH-2C at instrument vault at Cooling tower T 1B	Indicates high resistance within pipeline
Unit 1 Return	MH-2A at Tent 2	MH @ valve vault at cooling tower 1B	Indicates high resistance within pipeline
Unit 1 Return	MH-2A at Tent 2	MH-2B at instrument vault at cooling tower 1A	Positive shift in potential - pipeline is discontinuous from MH-2C to Instrument vault at cooling tower 1A
Unit 1 Return	MH-2A at tent 2	MH-1B near condenser building	Positive shift in potential - pipeline is discontinuous from MH-2A to MH-1B
Unit 2 Supply	MH-BB-S at Tent 2	Supply Pipe at Pump House	Indicates high resistance within pipeline
Unit 2 Supply	MH-BB-S at Tent 2	MH-AA at Condenser building	Indicates high resistance within pipeline
Unit 2 Return	MH-BB-R at Tent 2	MH-CC-R at instrument vault at Cooling tower T 2B	Indicates high resistance within pipeline
Unit 2 Return	MH-BB-R at Tent 2	MH-DD-R @ valve vault at cooling tower 2B	Indicates high resistance within pipeline
Unit 2 Return	MH-BB-R Tent 2	MH-EE-R at instrument vault at cooling tower 2A	Indicates high resistance within pipeline
Unit 2 Return	MH-BB-R at tent 2	MH-AA-R near condenser building	Large variation from Base Value potential - pipeline is discontinuous from MH-BB-R to MH-AA-R

The results of the continuity tests confirm that the pipelines are electrically discontinuous to the extent that cathodic protection cannot be applied for corrosion control of the prestressing wires until complete electrical continuity is established between discontinuous sections.

Conventional DC current from the application of cathodic protection uses the steel pipeline (all steel components of the PCCP) for the negative return path of DC current to the rectifier power source. If the pipeline is discontinuous, the DC current will take other less resistive paths back to the power source, and the current will discharge from the pipeline, into the soil electrolyte, dissolving metal ions in solution from the steel pipe and causing corrosion at the discharge point. To provide effective cathodic protection, the metallic structure must be electrically continuous.

2.2. Unit 1 Condenser Water Boxes

The cathodic protection systems were de-energized at the time of this inspection due to shut down maintenance to the Unit 1 generating system.

The inspection of the condenser water boxes focused on the internal condition of the water boxes from physical inspection. The cathodic protection systems were preliminarily evaluated from monthly data records.

The following information is provided from these inspections.

2.2.1 Unit 1 - Cathodic Protection Systems

- Refer to data table D. This data sheet was compiled as a result of the review of the operating history of the CP systems associated with the condenser water boxes. Additional anodes and reference electrodes may be damaged and this can only be determined by the actual operation of the cathodic protection systems.

  Replacement electrodes for the damaged reference electrodes identified are in stock and are scheduled to be replaced prior to Unit 1 being placed back into operation.

  The anodes that exhibit zero current output should be replaced. At the time of the inspection, the maintenance department has a total 10 anodes in stock. These anodes will be installed at various water boxes in condensers A, B and C as determined by the data sheet.

- Based on the operating history, many of the cathodic protection systems have not been in operation for up to two years. This is confirmed by the degree of corrosion observed in the respective water boxes.

- The cathodic protection systems appear to be placed in the manual mode of operation as controlled by the toggle switch on the rectifier panel. The automatic potential control card is used for automatic potential control operation, but it is likely that the systems are not functioning properly because of the toggle switch being in the manual position. It is noted that Unit 2 cathodic protection systems all operate with the toggle switch in the Automatic mode of operation.

- Several reference electrodes provide an input signal more negative than the alarm trip set potential of -850mV. This has resulted in the cathodic protection system being turned off and remaining off due to high level trip alarm. The systems affected in this manner are: SCR-6, SCR-11, SCR-16 and SCR-19.

  When the reference cells are compared to a new calibrated Ag/AgCl reference electrode, they exhibit a more negative value than the calibrated cell (typically -70 to -80 mV). They do not, however, exhibit a substantially more negative variation to the extent that the input signal exceeds the -850 mV alarm trip set potential.

  The cause of this is unknown and will be further investigated when the systems are in operation. It may be that feedback to the set potential circuitry is being influenced somehow and causing an erroneous signal exceeding the -850 trip alarm set potential which would indicate a faulty printed circuit card.

- Salt deposits have been observed on the compression terminal lugs at the reference cell terminal block relay inside the anode junction boxes of several cathodic protection systems. This indicates that water is seeping (wicked) in between the copper conductor and the cable insulation for the tubesheet reference electrodes. The salt deposits are only apparent on the reference electrodes installed on the tubesheets within the water boxes, and not on the through hull type electrodes mounted on the water boxes. This may ultimately lead to failure of the input signal from the reference electrode lead wire.

- An external resistor is placed between the negative and positive DC output terminals of each cathodic protection system in both Unit 1 and Unit 2. Discussions with maintenance and engineering personnel note that this was necessary to provide additional control of the set potential circuitry as the rectifier units have been over designed in regards to DC voltage. The actual total circuit resistance is much lower than originally estimated for in the design of the cathodic protection systems, and the rectifier units operate at a very low and inefficient DC voltage output.

  This results in a parallel circuit with the current circulating through the circuit. The total current output as measured at the 0.01 ohm anode current shunt for each anode will not match the total current of the rectifier.

2.2.2 Internal Water Box Inspection

The internal condition of the water boxes A, B and C associated with condenser Unit 1 were visually inspected. Refer to the photographs included in Appendix B for photographic documentation.

- The condition of the water boxes varies from condenser to condenser in regards to both the condition of the coating and observed corrosion of the water box. In general, condenser C was in better condition as the supply water enters this unit first and therefore has a much lower water temperature than condensers A and B.

- The water boxes which had their cathodic protection system turned off for a year or more were observed to have more corrosion and coating damage.

- Several tubesheet reference electrodes were damaged or missing from the tubesheet due to the turbulence of the circulating water.

- Ferrous oxide build up (tubercles) can be seen in several water boxes at damaged areas of the coating. This is indicative of insufficient cathodic protection current density required for protection of the steel water boxes.

- The condition of the water box coating system is generally in poor condition for condensers A and B which is somewhat attributable to the higher operating water temperatures in these units. The coating system in condenser C is in much better condition.

- The quality of the interior coating system within the two auxiliary cooling water heat exchangers is in very good condition with no signs of corrosion. The coating system and cathodic protection systems are providing adequate corrosion control to these structures.

- Repairs have been made to the coating system in some of the condenser water box units, but these repairs have not generally held up to the severe operating conditions and are peeling away from the originate coating substrate.

- It has been reported that the tubesheets are no longer being provided with a coating system when coating repairs are made to the condenser water boxes.

- No coating repairs were scheduled for the water boxes during this Unit 1 shut down.

- The coating on the tubesheets is used to encapsulate the reference electrode lead wires from the tubesheet to the reference electrode seal fitting. As the coating continues to deteriorate on the tubesheet, the reference electrode lead wires become exposed and fail. This will require another method to secure the reference cell lead wire to the tubesheet.

2.3 Unit 2 Condenser Water Boxes

The cathodic protection systems associated with the Unit 2 condenser were inspected during the normal operation of Unit 2. The systems were checked for Rectifier DC Output, Anode Current Output and Reference Cell Potential. In addition, efforts were made to select the optimum reference electrode that would provide the best distribution of current to the water box and tubesheet structures without exceeding the alarm signal and alarm trip set parameters of the Rochester Systems Alarm Control.

- The rectifiers are presently being operated in an automatic mode of operation at a set potential of -700 mV. This is an "On" potential measurement and does not account for IR error in the measurement circuit.

- The Rochester Systems monitor / alarm uses the following set potential parameters for system monitoring:

  a. High alarm alert: -750 mV (panel warning light activates)
  b. Low alarm alert: -450 mV (panel warning light activates)
  c. High alarm trip: - 850 mV (T/R unit trips off at SCR)

- Each cathodic protection system was found using reference electrodes numbered 1 or 2 for the input signal to the automatic potential controller. These two reference electrodes monitor the potential of the steel water box and are mounted on the water box in a through hull type configuration. This reference electrode is not necessarily the optimum electrode to use for control of automatic operation.

  In each case, the reference electrodes mounted on the tubesheet were significantly more positive than the reference electrodes monitoring the steel water box.

  As outlined above, the reference electrode measurements are current "On" potential measurements and include IR error in the measurement circuit. Therefore, to accurately determine the "polarized" potential of the structure, "instant off" potential measurements must be recorded.

  The steel water box can be operated at a maximum negative potential value of -1.1 volt "instant off" without causing overprotection to the steel. The maximum negative limit for the titanium tube / aluminum-bronze tubesheet structure is -0.70 volt "instant off" without causing overprotection of the titanium tubes.

  Therefore, one of the reference electrodes mounted on the tubesheet should be used to provide a -0.70 volt "instant off" input signal for automatic potential control operation. With this arrangement the steel water box will be provided with a higher current density required for protection. The tubesheet structures will be also be provided with a higher degree of protection without exceeding the -0.70 volt threshold value.

  To evaluate and select the optimum reference electrode for potential control, it is necessary to record instant off potential measurements of each reference electrode in the water box using a strip chart recorder or data logger to provide polarization curves. From this data it can also be determined if the "instant off" values are more positive than the values identified above.

- Further to the above, the alert alarm and alarm trip set points on the Rochester System Monitor alarm associated with reference electrode numbers 1 and 2 could be increased to a significantly more negative value such as -1.2 volt or more negative "On" potential. This would allow the tubesheet electrodes to operate at or near -0.70 volts without causing the High-High Trip alarm to activate and shut down the rectifier unit.

- Refer to Data Table E for information related to the final adjustments made to the rectifier units associated with the Unit 2 condenser cathodic protection systems.

2.4 Circulating Supply Water Pipelines

The cathodic protection system associated with the six (6) steel supply pipelines located immediately outside the pump house was inspected and adjusted for optimum performance.

Instant off potential measurements were initially recorded at each of the test stations located directly over the steel pipelines with the cathodic protection system operating at a DC output 9.42 V/ 8 A.

The results of the test indicated that the pipelines are meeting the 100 mV polarization criterion for cathodic protection with the exception of test station number 6 on the south pipeline. This location is marginally protected with -96 mV of polarization.

The system was adjusted to a 13.1 V / 10 A DC output and another set of "instant off" potential measurements was recorded. This adjustment provided adequate levels of cathodic protection meeting NACE criteria for protection to each of the six steel supply pipelines at the circulating water pump house.

The "instant off" potential measurements should remain more positive than -900 mV to ensure that over protection of the prestressing wires does not occur. At the present time, these polarized potentials are more positive than -850 mV.

Test station number 3, south supply line of unit 1 is presently operating at an instant off potential of -850 mV. This pipeline should be tested upon our return to ensure that the increase in DC output recently made to the rectifier unit does not exceed the maximum -900 mV instant off threshold.

Refer to data Table B for the results of the tests.

2.5 Soil Resistivity Tests

Soil resistivity testing was conducted on approximate 500 foot intervals along the pipeline route beginning at the Unit 1A and 2A cooling towers to the condenser building wherever sufficient space was available to record the measurements.

The Wenner 4 Pin method was used and the measurements were recorded to an average depth of 5, 10, 15 and 20. The results of the test are included in data Table C and will be used in the design of the cathodic protection system.

The soil resistivity values are expressed in ohm-cm values and the tests ranged from 500 to 29,000 ohm-cm. These values are considered very corrosive (less than 2000 ohm-cm) to progressively less corrosive (greater than 10,000 ohm-cm).

The soil is very corrosive to moderately corrosive along the length of the pipeline alignment.

Refer to data table C for the results of the tests.

3.0 Recommendations

3.1 Electrical Continuity of PCC Pipe

A detailed internal electrical continuity test and bonding program is required for the Unit 1 and 2 Supply and Return pipeline structures prior to the implementation of cathodic protection for corrosion control. The program needs to consist of further electrical continuity testing on 100 foot or 5 pipe joint sections with immediate bonding of discontinuous sections of pipe.

The program should be conducted in two phases during the 2006 Unit 2 and 2007 Unit 1 plant shutdown schedule.

Consideration will be given to minimizing the amount of wire to be used for the continuity testing, but it should be noted that small gauge wire will need to be provided from the top of the manhole to reach the sections of pipeline joints under test. This wire may be suspended from the lighting systems within the pipeline.

The continuity test is conducted by setting up a temporary DC current source on the pipeline under test which is similar to the tests recently conducted.

The concrete mortar of the pipe joint at the beginning or at the end of the pipeline section is chipped away to expose both the bell and spigot ends of the joint. An on/off potential measurement is recorded at the first joint on both sides (bell and spigot ends) of the joint. If the potential measurement is the same the joint is electrically continuous and the process proceeds 100 ft (5 joints) downstream where the concrete mortar is again chipped away to expose the bell and spigot ends of the cylinder.

If the potential measurement varies across the joint, by more than 50 mV, then strapping bonds are welded across the bell/spigot joint at three (3) positions of the pipe joint to provide for current carrying capacity and redundancy. The bonding straps will be made of Number 4 AWG flexible cable with a 2-inch x 0.25" steel rod thermite welded to each end of the cable. The mortar is repaired and the process is then moved downstream another five (5) pipe joints and the testing continued.

The above testing / bonding program will ensure of complete electrical continuity of the PCCP and is recommended to be implemented on each of the supply and return pipelines for both Unit 1 and Unit 2, inclusive of the four (4) PCCP supply pipes from the cooling towers to the circulating water pump house reservoir.

A proposal will be prepared for Intermountain Power that will outline the scope of work, survey methodology, materials and cost estimates required to conduct the electrical continuity bonding program and will be submitted under separate cover.

3.2 Cathodic Protection Design

The design of the cathodic protection system should proceed as scheduled. Corrpro have sufficient information relative to the protective current densities required of the PCCP pipelines. What remains to be determined is to estimate the other underground foreign metallic structures that will also collect cathodic protection current intended for the PCCP. These structures will include other metallic structures such as water and sewer lines, electrical conduit and electrical grounding systems.

Corrpro have contacted RB&G to provide assistance to obtain boring samples at approximately twelve (12) to fifteen (15) locations along the pipeline route, and MCM Engineering to locate, mark and provide GPS coordinates of the pipelines. The soil samples will be tested for sulfate and chloride concentration, pH, soil conductivity and moisture content. The data is used in the design of the cathodic protection system.

Samples of mortar and wire from the failed pipe sections have been collected for laboratory testing and the results of this data will be presented in the final report for the design of the cathodic protection system.

A cost estimate for the design requirements of the proposed cathodic protection system for the PCC pipe is included in Appendix C.

3.3 Cathodic Protection Systems for Condenser Water Boxes

As discussed in section 2.2 and 2.3 above, the cathodic protection systems associated with the condenser water boxes in both Unit 1 and 2 should be further tested using data recorders to determine actual polarized potential curves. With this information in hand, final adjustments can be made to the cathodic protection systems in regards to proper reference cell control selection, and current output / distribution of the systems. The Rochester System monitoring alarms associated with reference cell numbers 1 and 2 (water box electrodes) for each system would be adjusted to a more negative value to avoid the tripping off of the system due to a high potential alarm.

Unit 1 cathodic protection systems should be further investigated under operating conditions which will identify all damaged anodes and reference electrodes which could not be identified when the systems were off.

- Corrpro recommends that the cathodic protection systems be totally refurbished during the 2006 Unit 2 plant shutdown and the 2007 Unit 1 plant shutdown. The infrastructure of the CP systems, i.e. rectifier units, anode junction boxes, and DC cabling are, for the most part, in excellent working condition.

  The systems are properly designed in regards to anode and reference cell location, only the consumable components of the system require replacement, the mixed metal oxide anodes and Ag/AgCl reference electrodes. No anodes have previously been replaced on the condenser water boxes for Unit 1 or Unit 2.

  Intermountain Power should consider the replacement of all anodes and all reference electrodes for all cathodic protection system in Units 1 and 2 during each of the next two plant shutdowns. When replacement anodes are installed, these replacements discharge a majority of the total current output, resulting in an uneven distribution of current to the water box and tubesheet.

- Many of the tubesheet mounted reference electrodes are failing within a two year operational life. Although this may seem to be premature failing, this can also be the result of the highly turbulent force of water through the tubesheet. Intermountain Power should consider procurement of reference electrodes from more than one manufacturer and conduct an evaluation on both a cost and performance basis. Corrpro will develop recommendations

- A cost estimate is provided in Appendix C of this report for the additional testing required of the condenser water box cathodic protection systems for Unit 1 and 2.

3.4 Circulating Water Pipelines

No further adjustments to this cathodic protection system should be required. An instant off potential measurement should be recorded at test station number 3, south supply pipeline of unit 1 to ensure the polarized potential is more positive than -900 mV. If the instant off potential is more negative than -900 mV, then the current output of the rectifier should be reduced from it's present tap setting of Coarse B / Fine 3 to Coarse B / Fine 2. Corrpro will perform the testing during the next visit.

3.5 Firewater Piping at Switchyard

The sacrificial anode cathodic protection system associated with the firewater piping loop around the switchyard remains to be tested as part of the original scope of work. This piping system will be tested during the next visit to Intermountain Power as part of the overall corrosion control program.

A cost estimate has been provided in Appendix C to conduct this testing.

APPENDIX A

DATA TABLES

UNIT 1 - CONDENSER WATER BOX					Table D - Sheet 1 of 2
Summary of Defective Reference Cell and Anodes From Data Sheet Operating History					
SCR No.	**Damaged Ref. Cell No. (WB)**	**Damaged Ref. Cell No. (TS)**	**Damaged Anode No.**	**Damaged Anode from History (4-19-04 & 5-24-04)**	**Comment**
1	Normal Ref. cell measurements	Normal Ref. cell measurements	8	n/a	-
2	Normal Ref. cell measurements	Normal Ref. cell measurements	1, 8	n/a	-
3	1	5	OK	n/a	-
4	2	3, 4, 7	5	n/a	-
5	Normal Ref. cell measurements	Normal Ref. cell measurements	No DC Output	History indicates unit off since 10-28-03 - Cannot determine damaged anodes	DC Output zero - Test / Reset rectifier unit
6	To take out and test ref. cell no. 1(1.15V)	Normal Ref. cell measurements	No DC Output	History indicates unit off since 10-28-03 High input by ref. cell no. 1; - Cannot determine damaged anodes	Rectifier tripped off due to upper limit potential. Ref cells 2-5 appear normal (native)
7	1	Normal Ref. cell measurements	OK	n/a	
8	1, 2	3	No DC output -	Unit appears off since 10-23-02; Cannot determine damaged anodes	T/R off. Reset/Troubleshoot rectifier ASAP
9	Normal Ref. cell measurements	4	1, 5	n/a	-
10	Normal Ref. cell measurements	3, 4	No DC output	Unit appears off since 10-28-03; Cannot determine damaged anodes	Reset / Troubleshoot T/R

11	To take out and test ref. cell no. 2 (1.71V)	4, 5	No DC output	Unit appears off since 4-19-04, High input by ref. cell no. 2; Cannot determine damaged anodes	T/R tripped, Reset / Troubleshoot
12	Normal Ref. cell measurements	3	check shunt anode no. 3 high reading (anode assumed OK)	n/a	
13	Normal Ref. cell measurements	3, 7	No DC output	Unit appears off since 10-28-03; Cannot determine damaged anodes	Reset / Troubleshoot T/R
14	Normal Ref. cell measurements	3, 6, 7	No DC output	Unit appears off since 10-28-03; Cannot determine damaged anodes	Reset / Troubleshoot T/R
15	Normal Ref. cell measurements	3	1, 3, 8	n/a	Retest anode output vs T/R output, Check Shunt no. 6
16	To take out and test ref. cell no. 2 (1.77V)	2, 3, 5, 6, 7	1, 9	Damaged Anode 1 and 9 from History (4-19-04 & 5-24-04)	Unit off as of 3-1-05, High input by ref. cell no. 2; Cannot determine damaged anodes
17	Normal Ref. cell measurements	4, 5	Minimum DC output	n/a	Retest with unit in operation
18	Normal Ref. cell measurements	Normal Ref. cell measurements	Minimum DC output (0.12 Amp)	n/a	Retest with unit in operation
19	To take out and test ref. cell no. 1 (1.11V)	5	Assume anodes are good.	Unit appears off since 10-28-03, High input by ref. cell no. 1; Cannot determine damaged anodes	Restest / troubleshoot with unit in operation
20	Normal Ref. cell measurements	4	OK	n/a	Restest for protection with unit in operation - inspection shows unit in very good condition

	Total Damaged = 9 electrodes (inclusive of to test electrodes)	Total Damaged = 25 electrodes (inclusive of to test electrodes)	Total Damaged = 11 Anodes (not including anodes with no T/R DC output)		
WB = Water box reference cell					
TS = Tube sheet reference cell					

UNIT 2 - CONDENSER WATER BOX					Table E - Sheet 1 of 2
Summary of Defective Reference Cell and Anodes From Data Sheet Operating History					
SCR No.	**Damaged Ref. Cell No. (WB)**	**Damaged Ref. Cell No. (TS)**	**Damaged Anode No.**	**Final DC Output**	**Comment**
1	Normal Ref. cell measurements	Normal Ref. cell measurements	OK	2.01V / 2.24A	Control Reference changed to No. 4
2	Normal Ref. cell measurements	3, 5,6 & 7	9	1.9V / 2.08A	Control Reference changed to No. 5
3	Normal Ref. cell measurements	4, 6	OK	1.87V / 2.08A	Control Reference changed to No. 7
4	2	3	5	1.89V / 2.08A	Control Reference changed to No. 5
5	Normal Ref. cell measurements	5	3	1.89V / 2.0A	Control Reference changed to No. 3
6	Normal Ref. cell measurements	3	OK	2.06V / 2.16A	Control Reference changed to No. 4
7	Normal Ref. cell measurements	Normal Ref. cell measurements	OK	1.93V / 2.16A	Control Reference changed to No. 5
8	Normal Ref. cell measurements	3, 4	4	2.12V / 2.48A	Control Reference on No. 2
9	Normal Ref. cell measurements	4	OK	1.8V / 1.54A	Control Reference on No. 1
10	Normal Ref. cell measurements	3, 4, 5	OK	2.0V / 2.16A	Control Reference on No. 1
11	Normal Ref. cell measurements	3, 4	OK	1 76V / 1.76A	Control Reference on No. 1
12	Normal Ref. cell measurements	3	3	1.93V / 2.08A	Control Reference on No. 2
13	Normal Ref. cell measurements	Normal Ref. cell measurements	OK	1.97V / 5.6A	Control Reference changed to No. 3
14	Normal Ref. cell measurements	4	9	2.05V / 2.4A	Control Reference changed to No. 3
15	Normal Ref. cell measurements	Normal Ref. cell measurements	OK	2.22V / 3.52A	Control Reference changed to No. 5

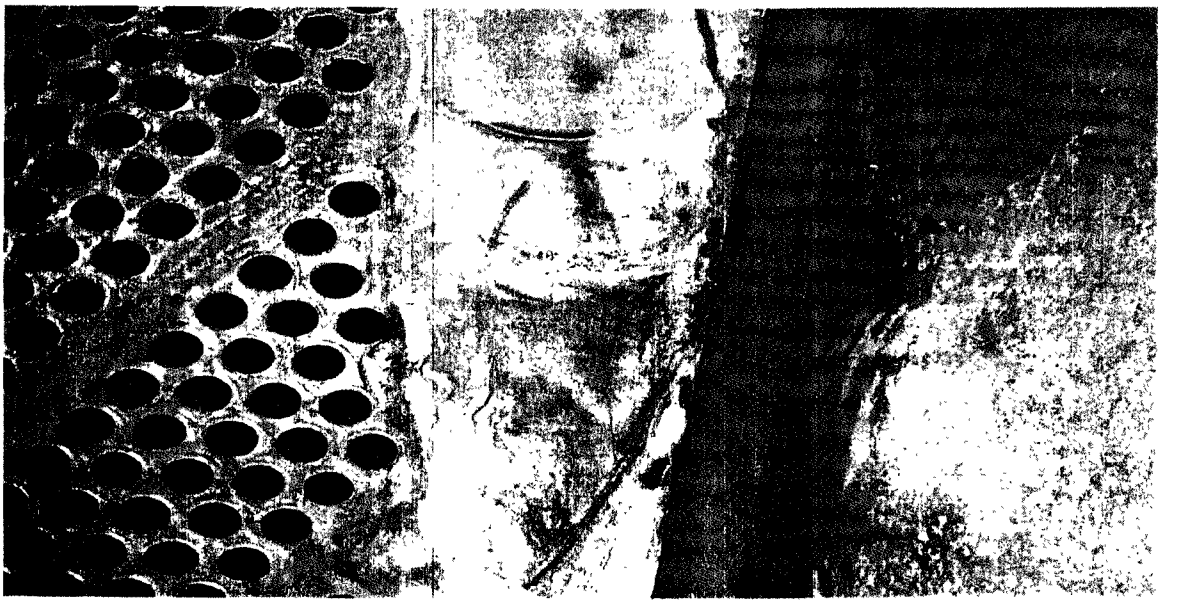
16	Normal Ref. cell measurements	Normal Ref. cell measurements	OK	2.06V / 3.04A	Control Reference on No. 2
17	Normal Ref. cell measurements	Normal Ref. cell measurements	OK	1.75V / 1.96A	Control Reference on No. 2
18	Normal Ref. cell measurements	Normal Ref. cell measurements	2	2.08V / 2.48A	Control Reference on No. 2
19	Normal Ref. cell measurements	Normal Ref. cell measurements	OK	1.9V / 1.80A	Control Reference on No. 1
20	Normal Ref. cell measurements	Normal Ref. cell measurements	OK	1.91 / 2.0A	Control Reference on No. 1
WB = Water box reference cell					
TS = Tube sheet reference cell					

APPENDIX B

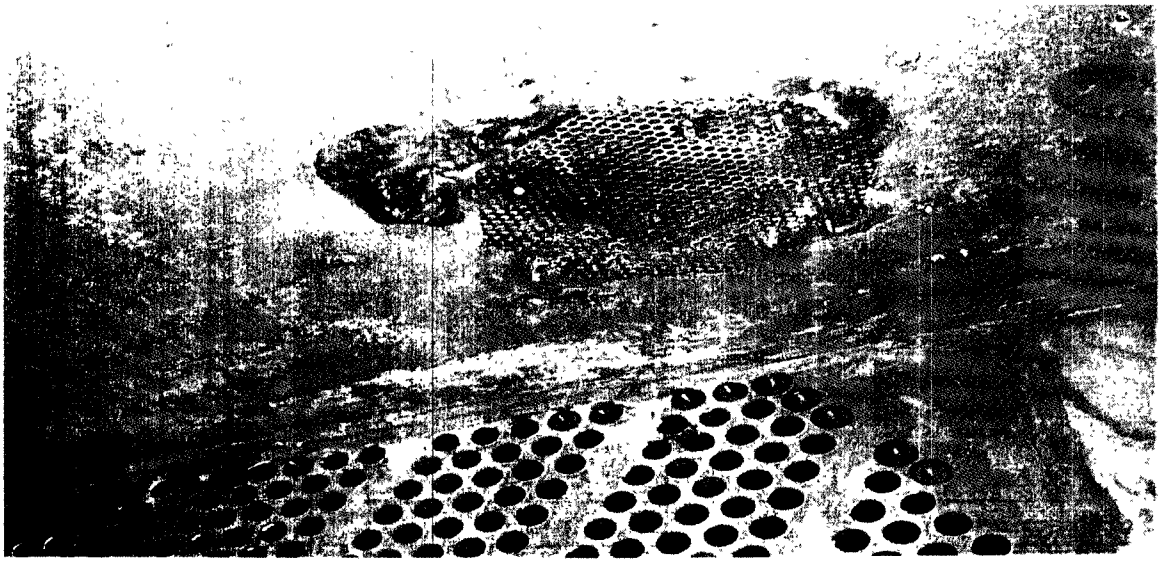
CONDENSER WATER BOX PHOTOGRAPHS

APPENDIX B

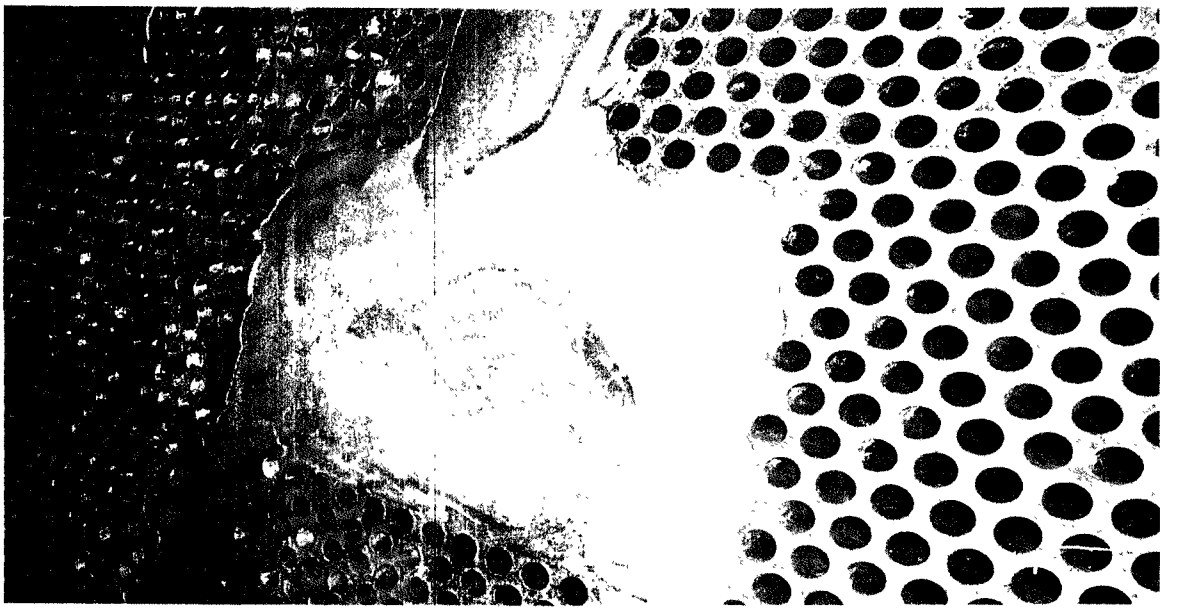
CONDENSER WATER BOX PHOTOGRAPHS



Picture 431 – Condenser A WB Inlet West - SCR-13

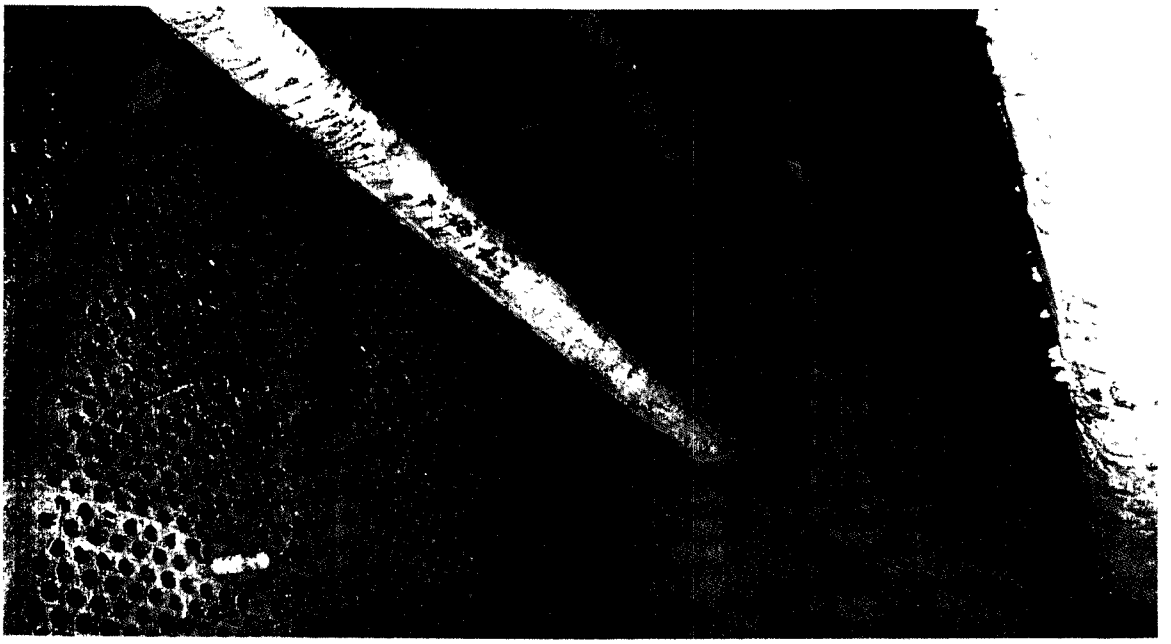


Picture 432 – Condenser A WB Inlet West - SCR-13

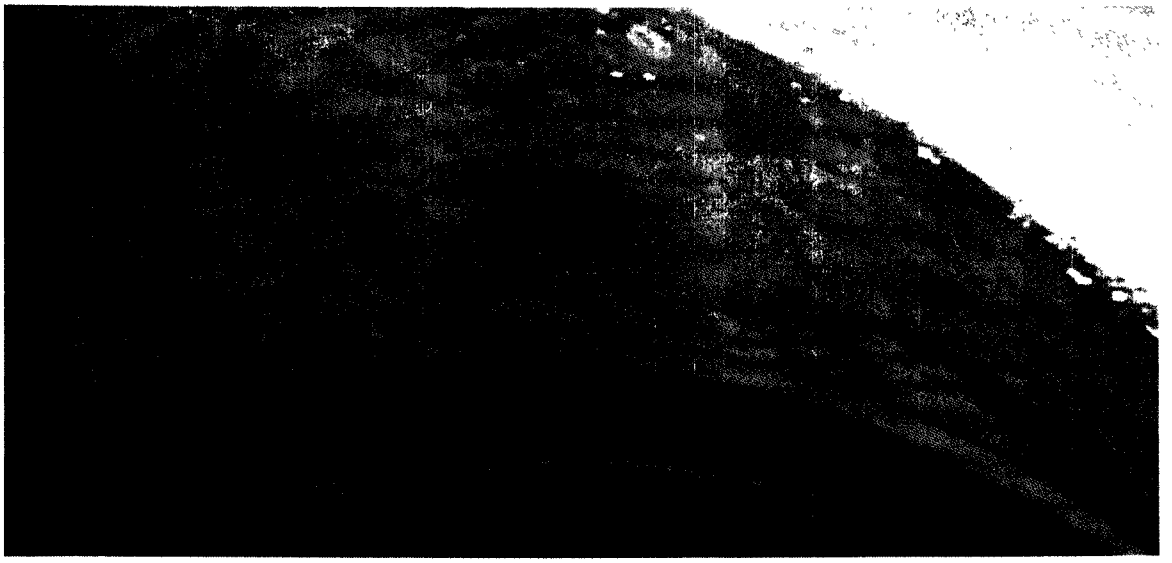


Picture 433 – Condenser A WB Inlet West - SCR-13

Picture 436 – Condenser A WB Inlet West - SCR-13

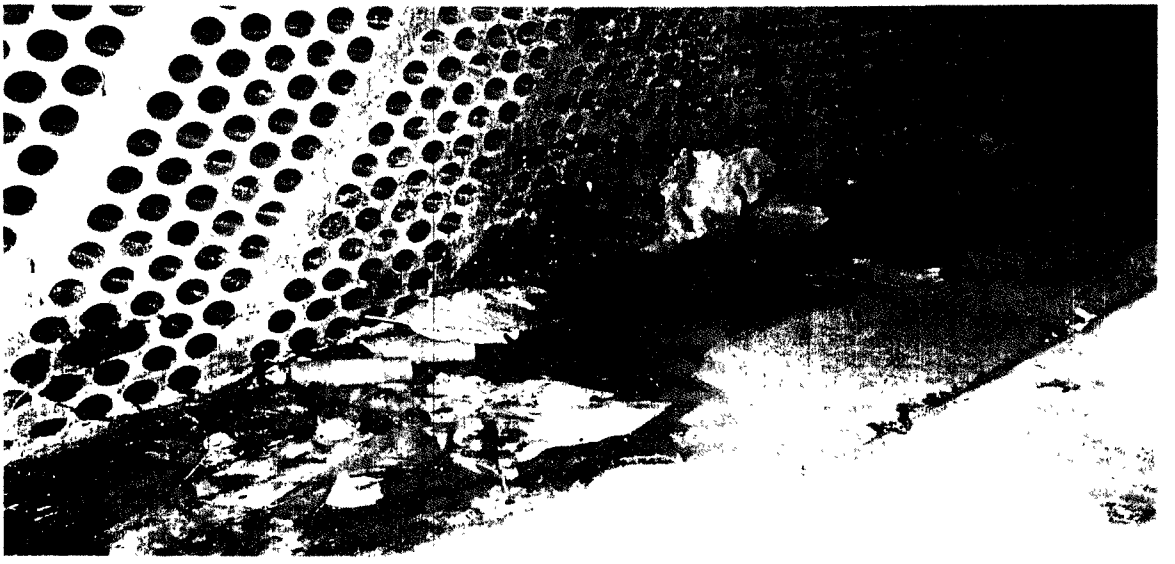


Picture 461 – Condenser A WB Inlet East - SCR-14



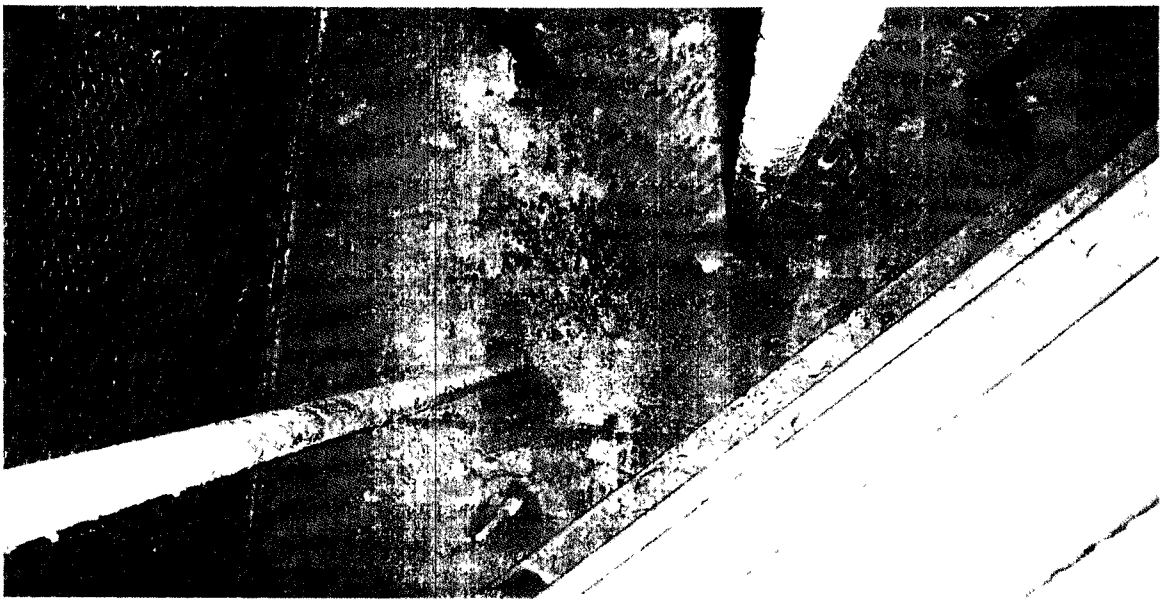
Picture 465 – Condenser A WB Inlet East - SCR-14

Picture 468 – Condenser A WB Inlet East - SCR-14



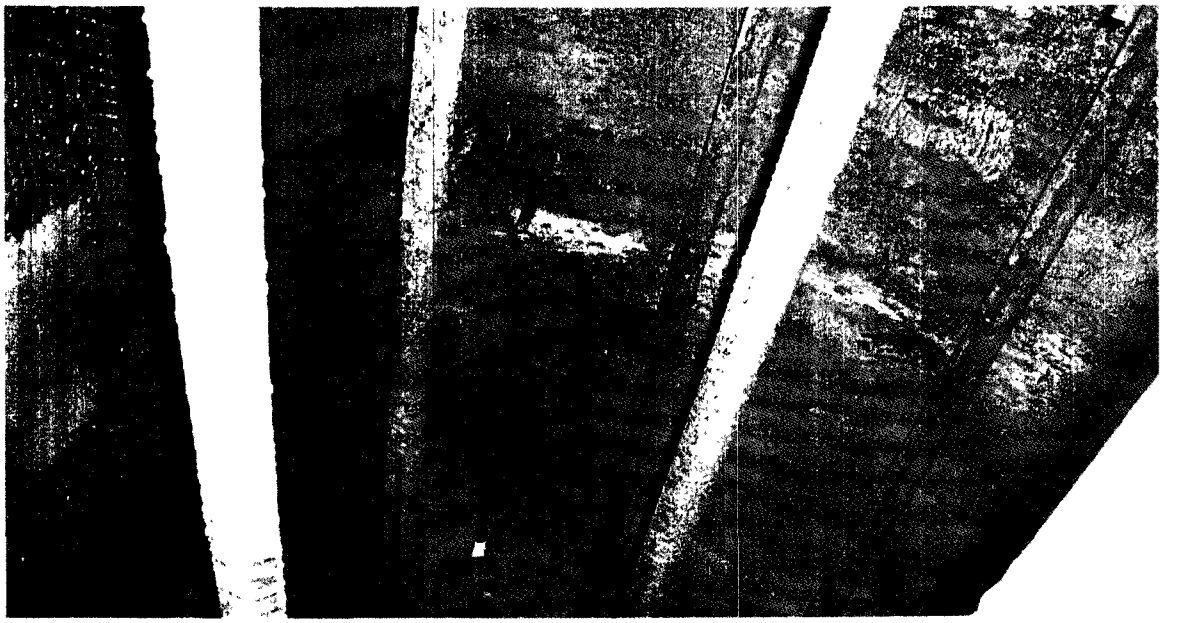
Picture 470 – Condenser A WB Inlet East - SCR-14

Picture 510 – Condenser A WB Outlet West - SCR-15



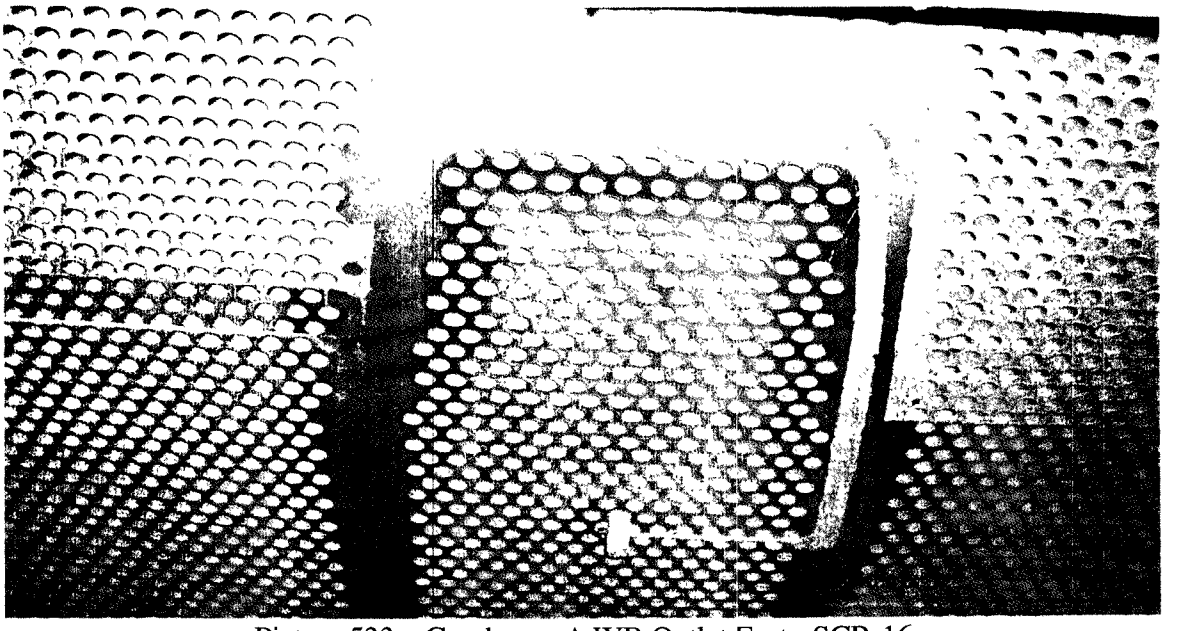
Picture 511 – Condenser A WB Outlet West - SCR-15

Picture 514 – Condenser A WB Outlet West - SCR-15



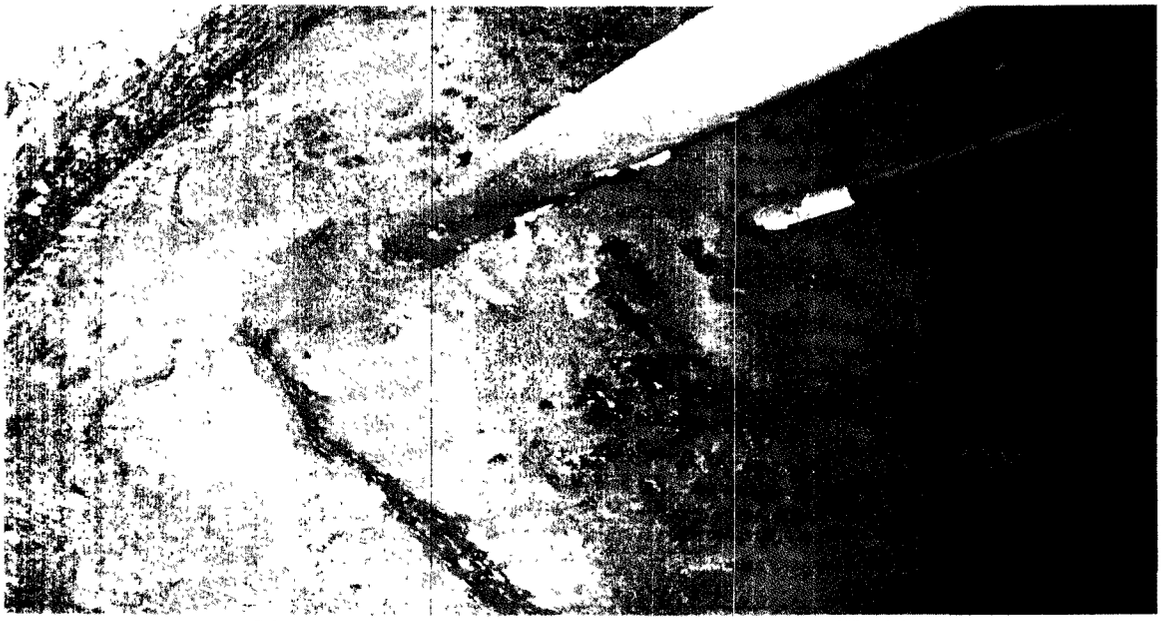
Picture 516 – Condenser A WB Outlet West - SCR-15

Picture 427 – Condenser A WB Outlet East - SCR-16

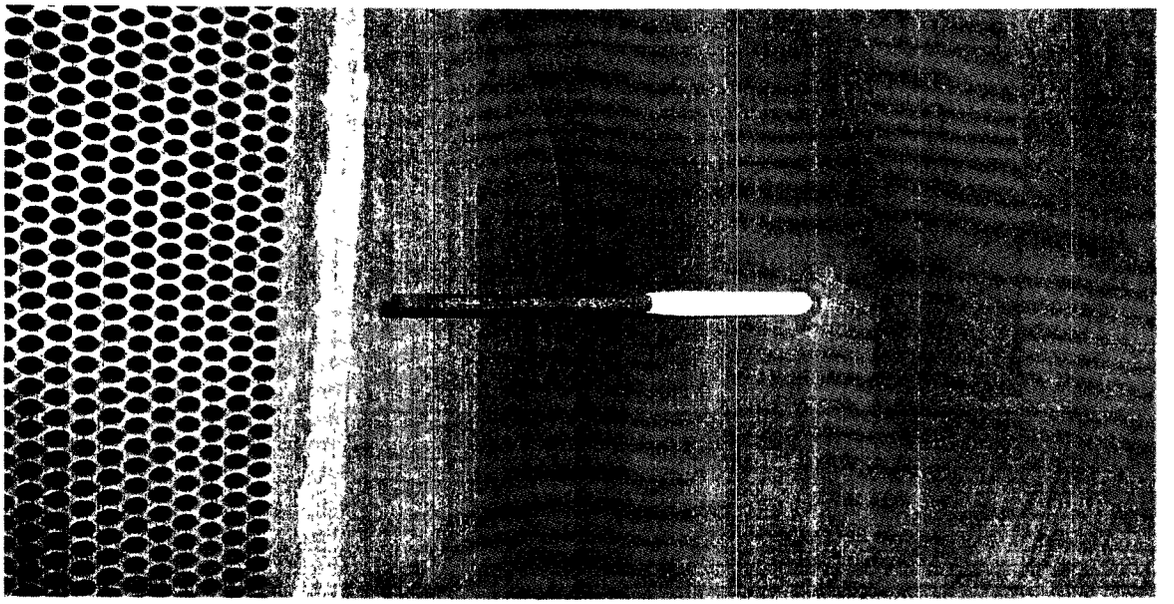


Picture 533 – Condenser A WB Outlet East - SCR-16

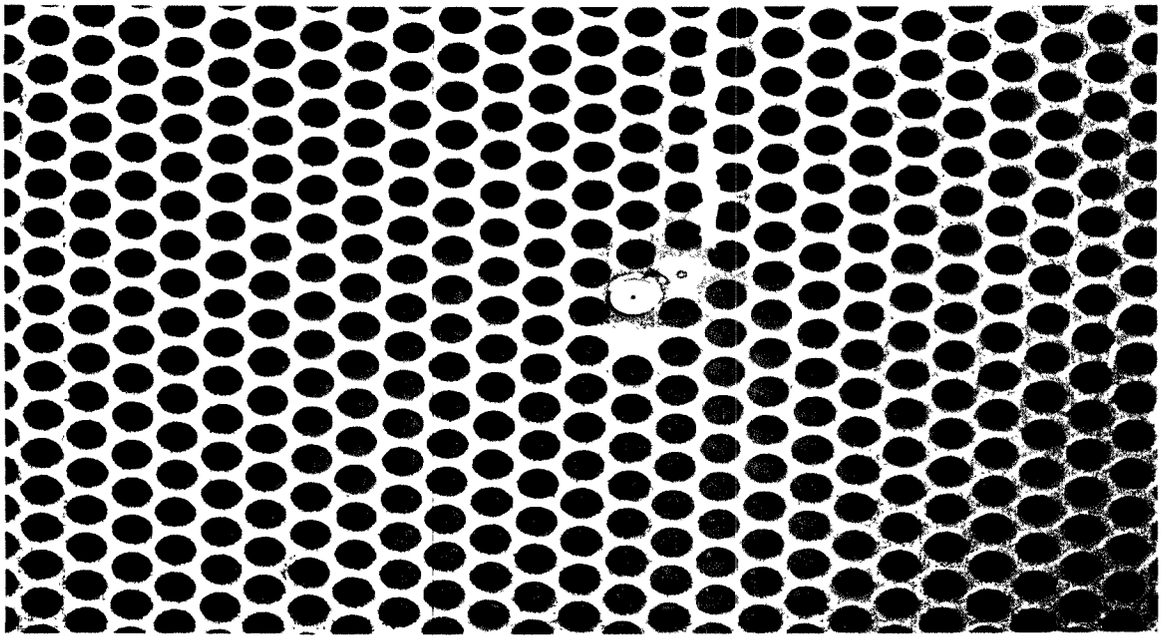
Picture 535 – Condenser A WB Outlet East - SCR-16



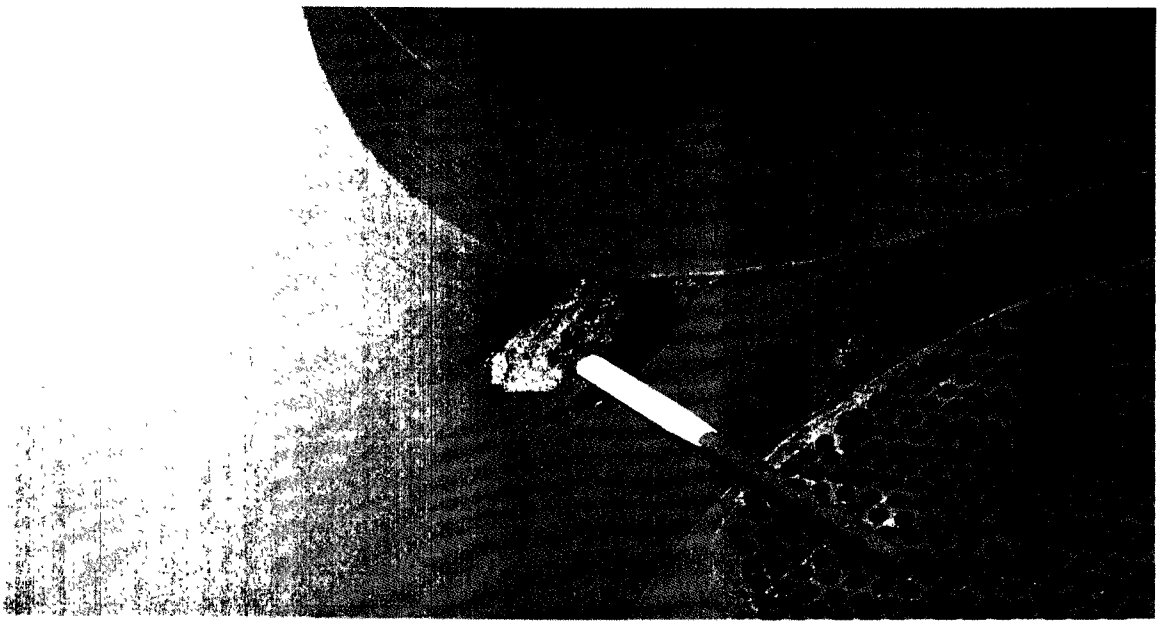
Picture 538 – Condenser A WB Outlet East - SCR-16



Picture 546 – Condenser A Aux Inlet - SCR-17

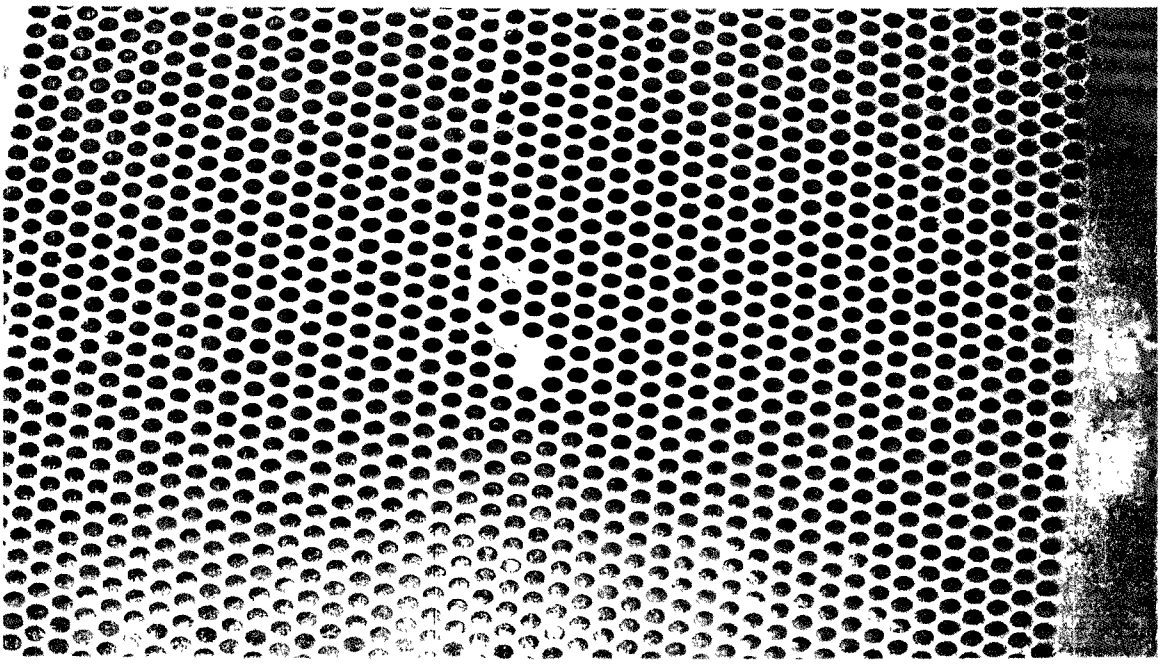


Picture 547 – Condenser A Aux Inlet - SCR-17

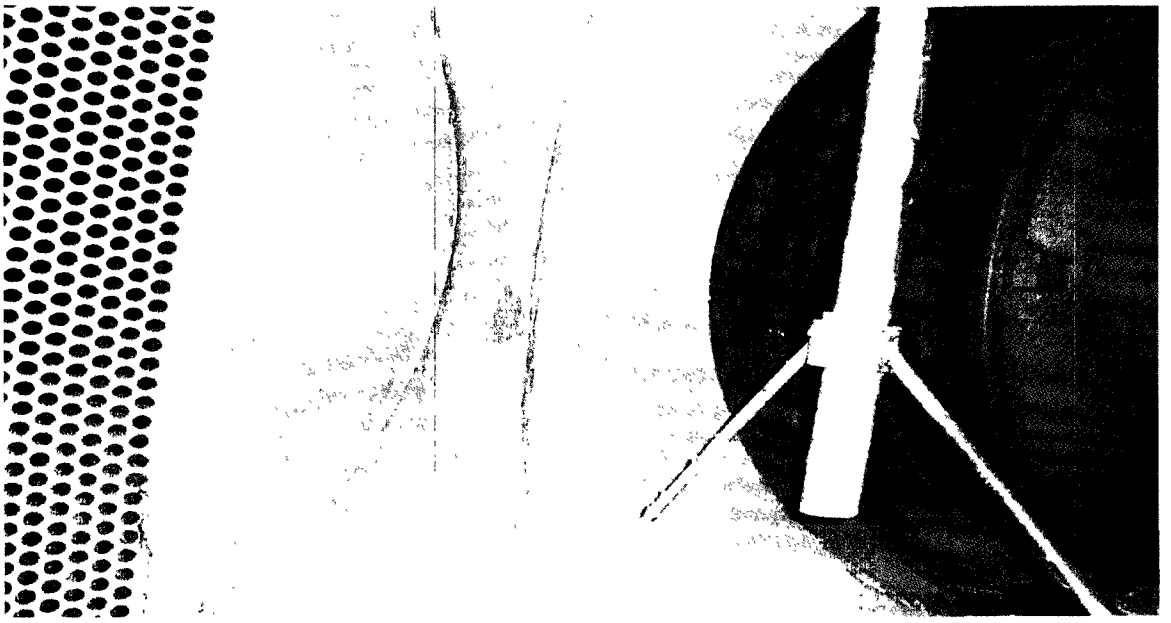


Picture 551 – Condenser A Aux Inlet - SCR-17

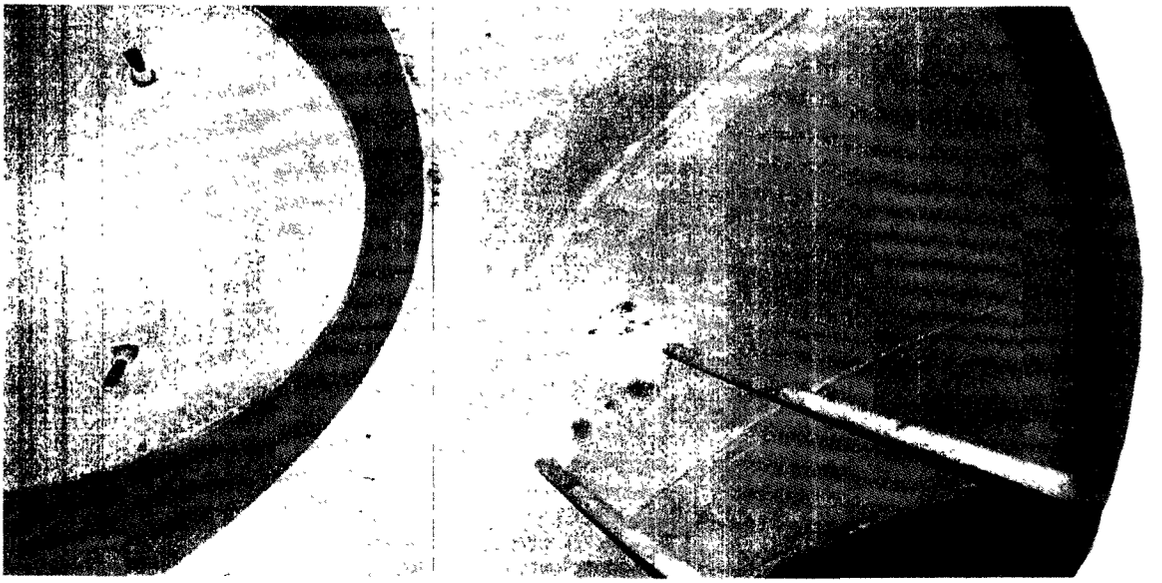
Picture 552 – Condenser A Aux Inlet - SCR-17



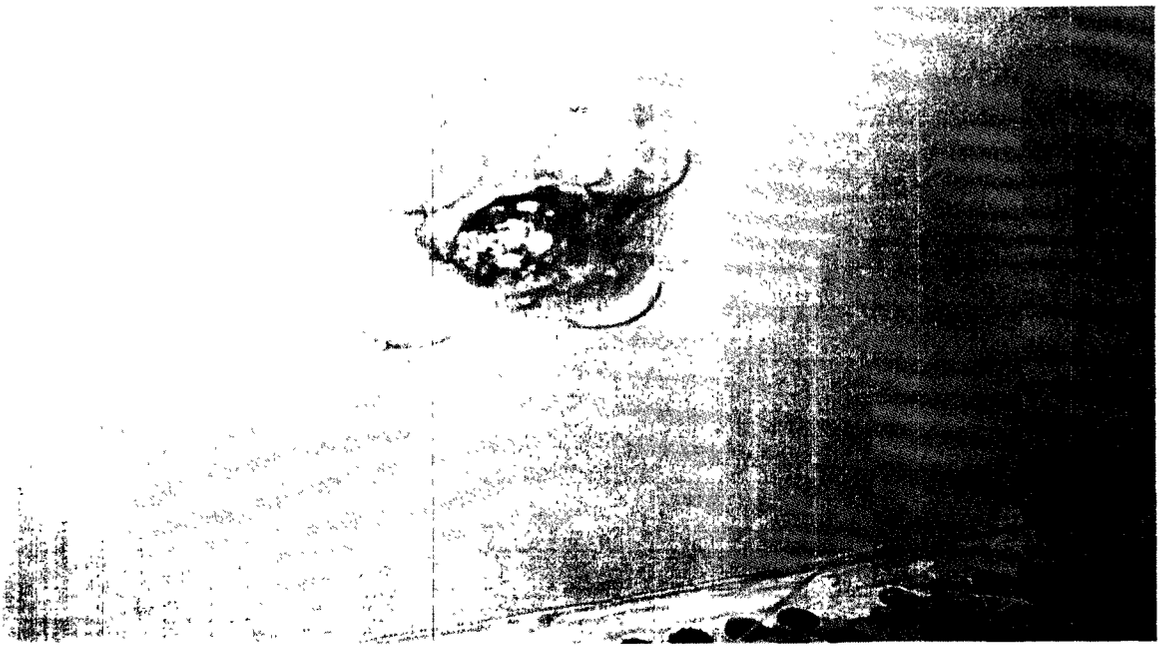
Picture 564 – Condenser A Aux Outlet - SCR-18



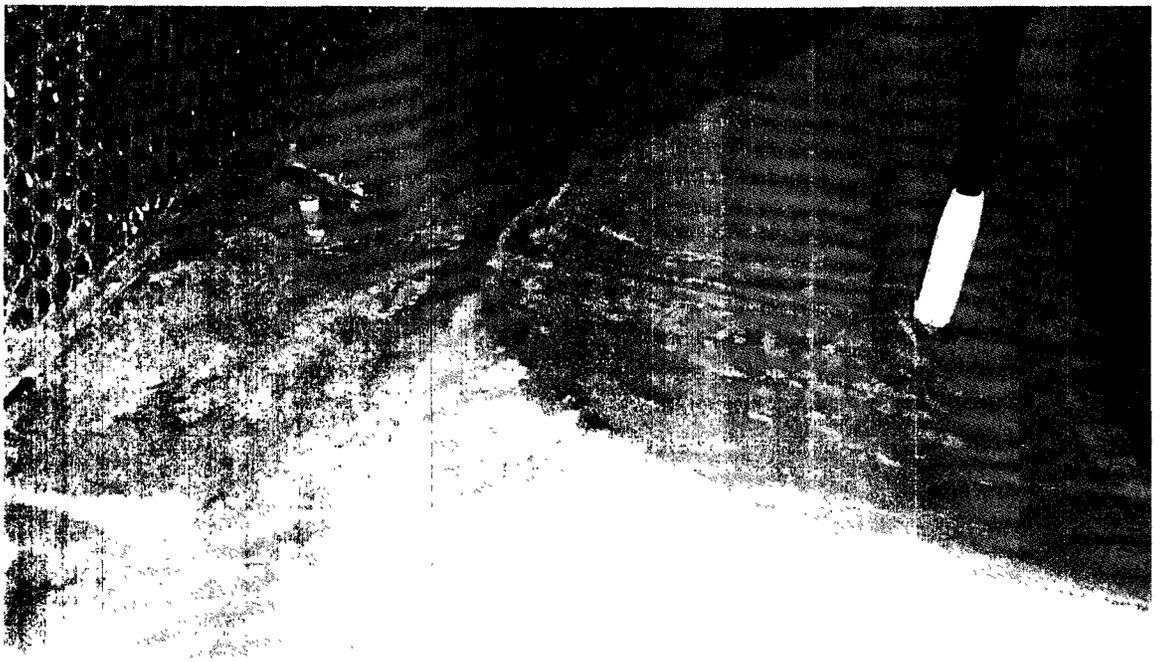
Picture 565 – Condenser A Aux Outlet - SCR-18



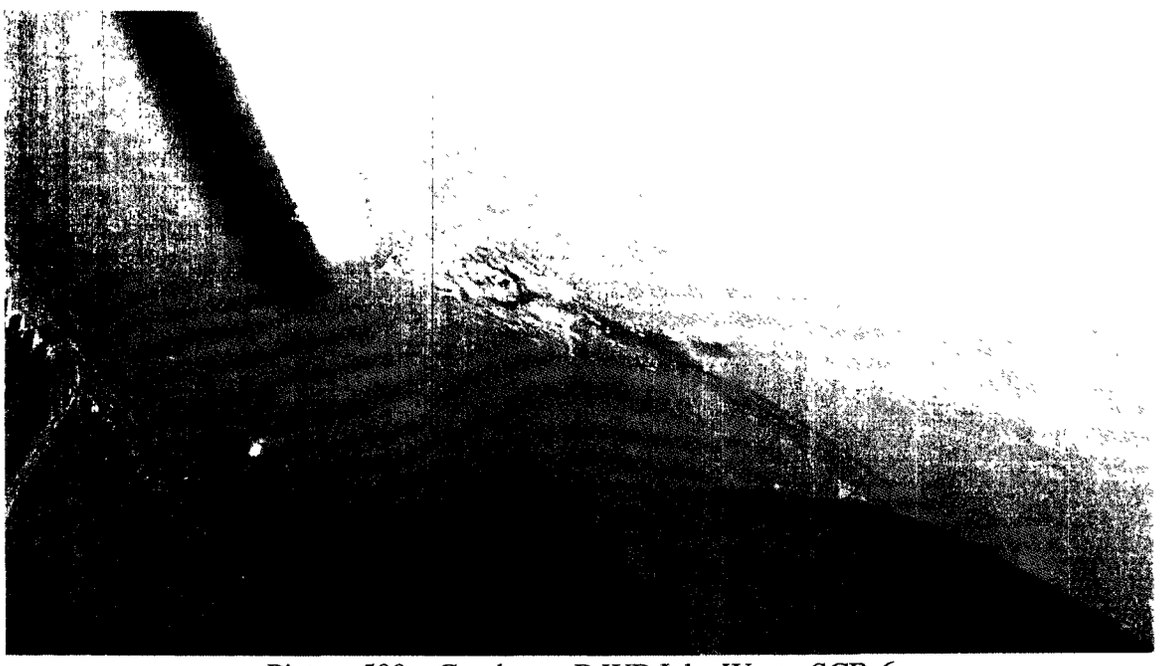
Picture 495 – Condenser B WB Inlet West - SCR-6



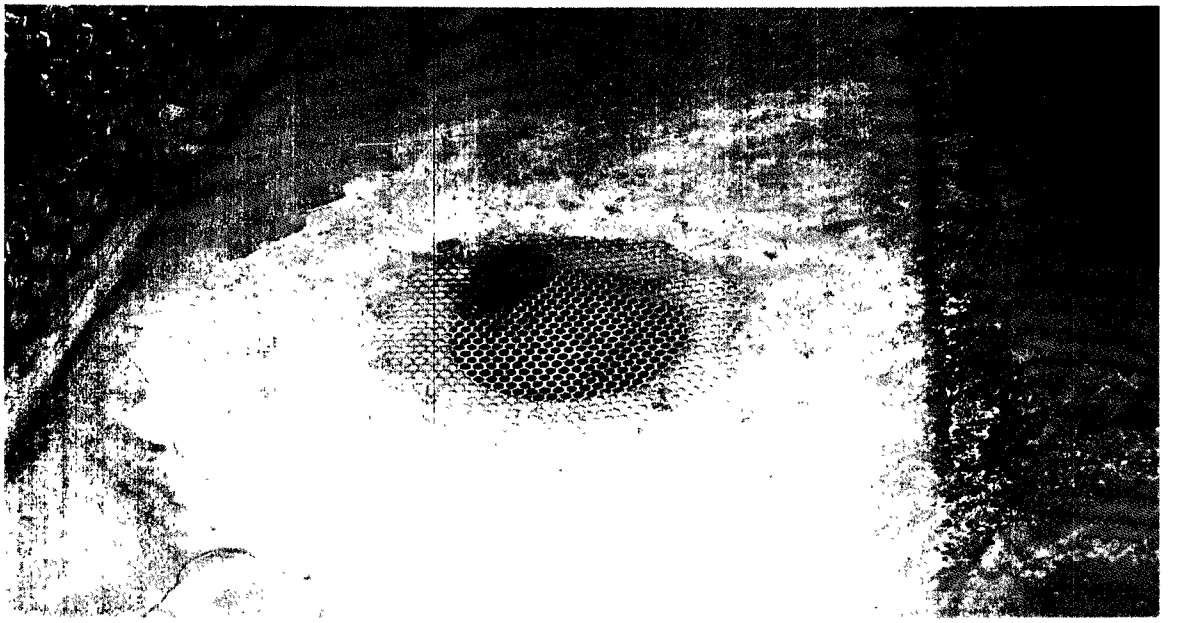
Picture 497 – Condenser B WB Inlet West - SCR-6



Picture 499 – Condenser B WB Inlet West - SCR-6

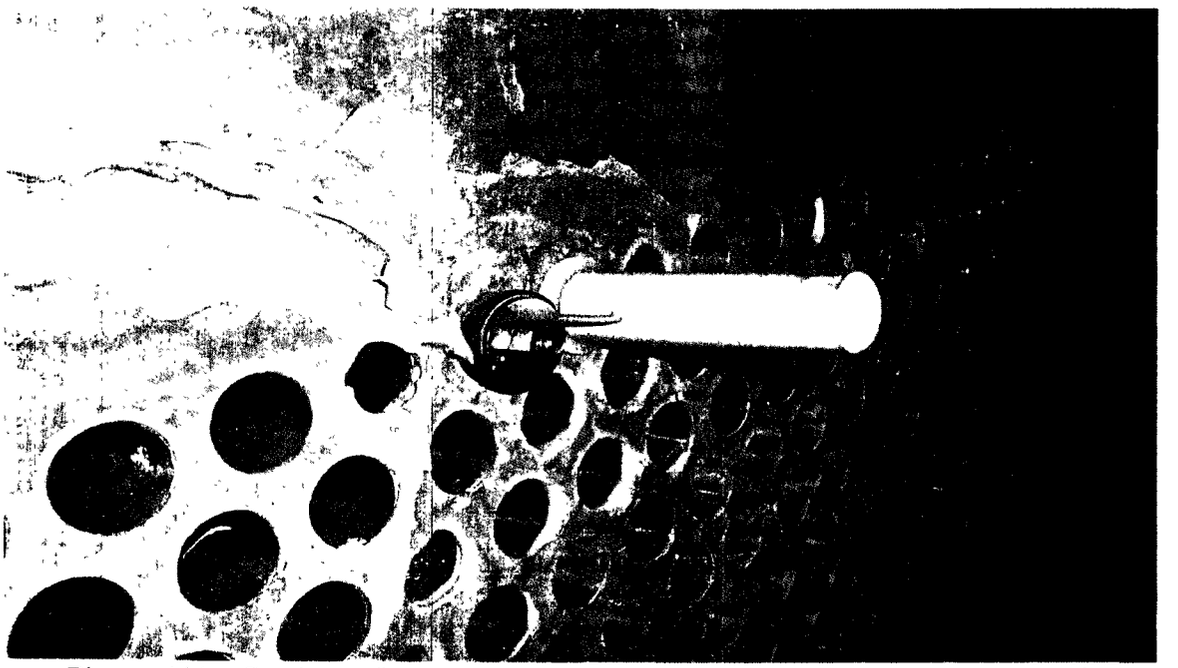


Picture 500 – Condenser B WB Inlet West - SCR-6



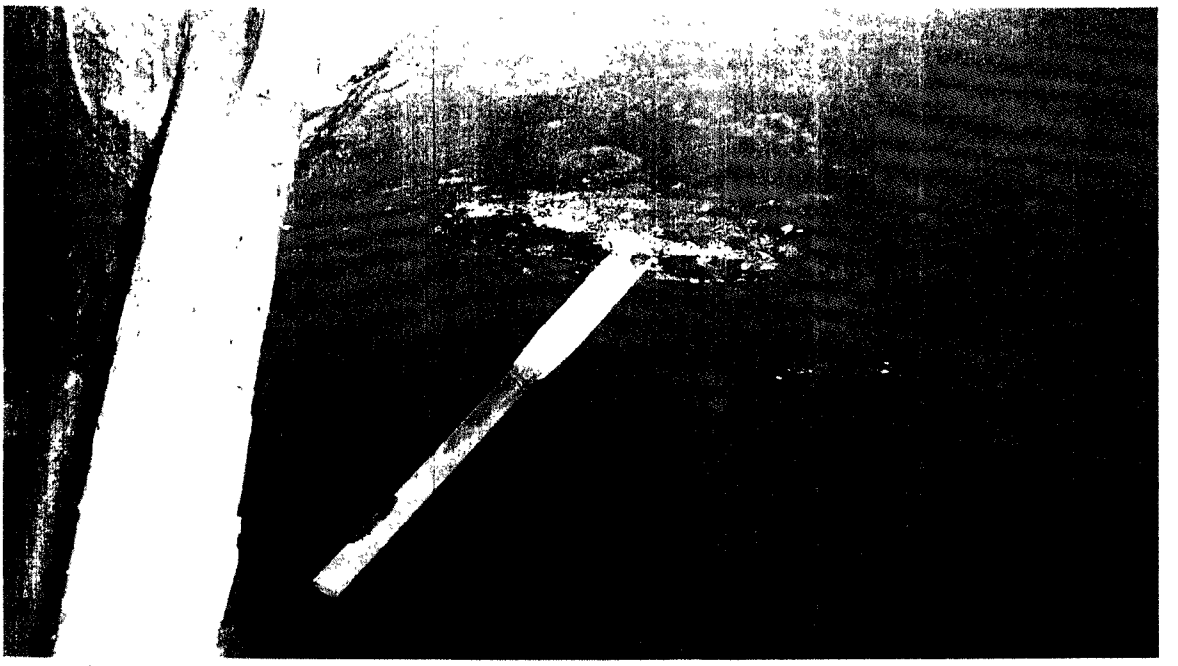
Picture 439 – Condenser B WB Inlet West & East Lower Crossover - SCR-11 & 12

Picture 441 – Condenser B WB Inlet West & East Lower Crossover - SCR-11 & 12



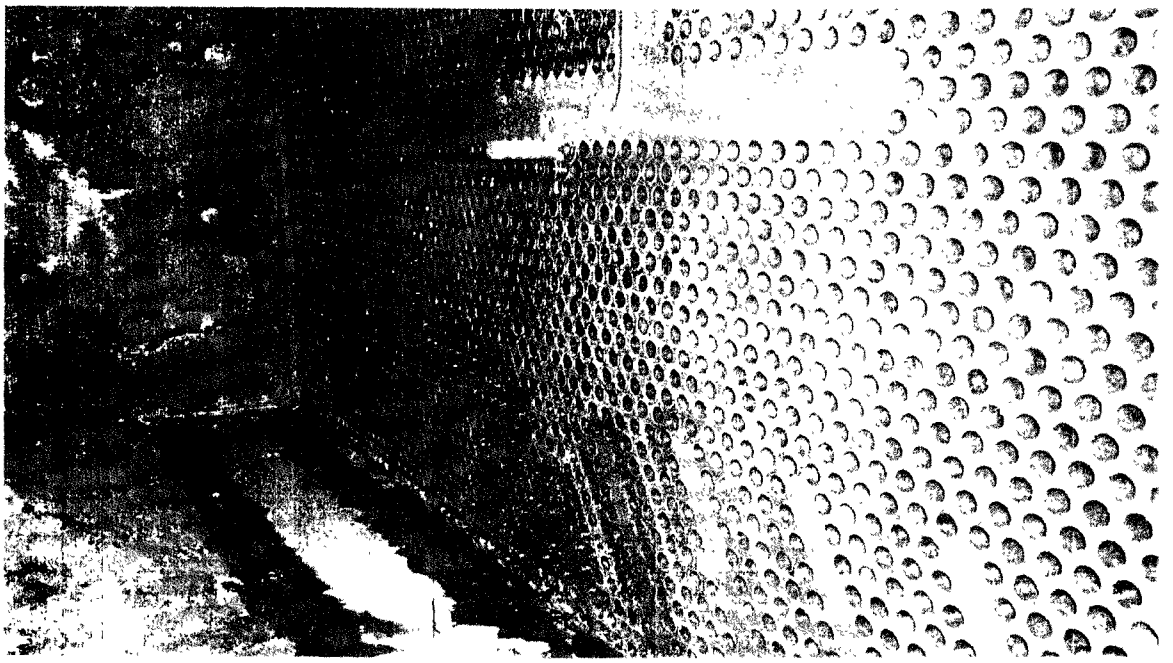
Picture 444 – Condenser B WB Inlet West & East Lower Crossover - SCR-11 & 12

Picture 445 – Condenser B WB Inlet West & East Lower Crossover - SCR-11 & 12

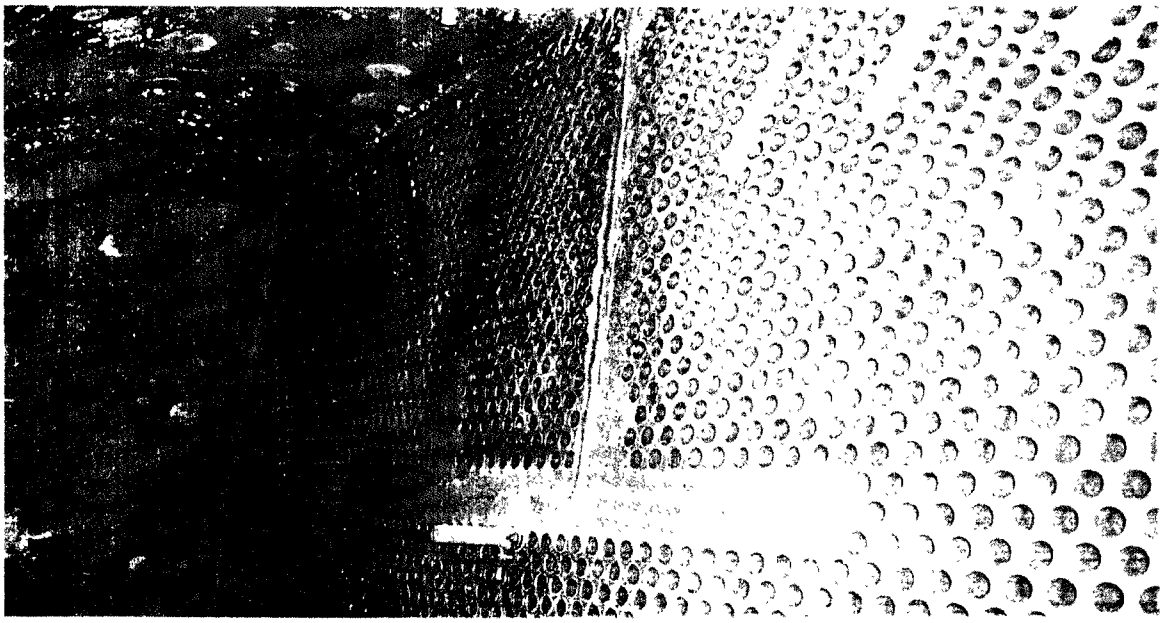


Picture 446 – Condenser B WB Inlet West & East Lower Crossover - SCR-11 & 12

Picture 452 – Condenser B WB Inlet West & East Lower Crossover - SCR-11 & 12

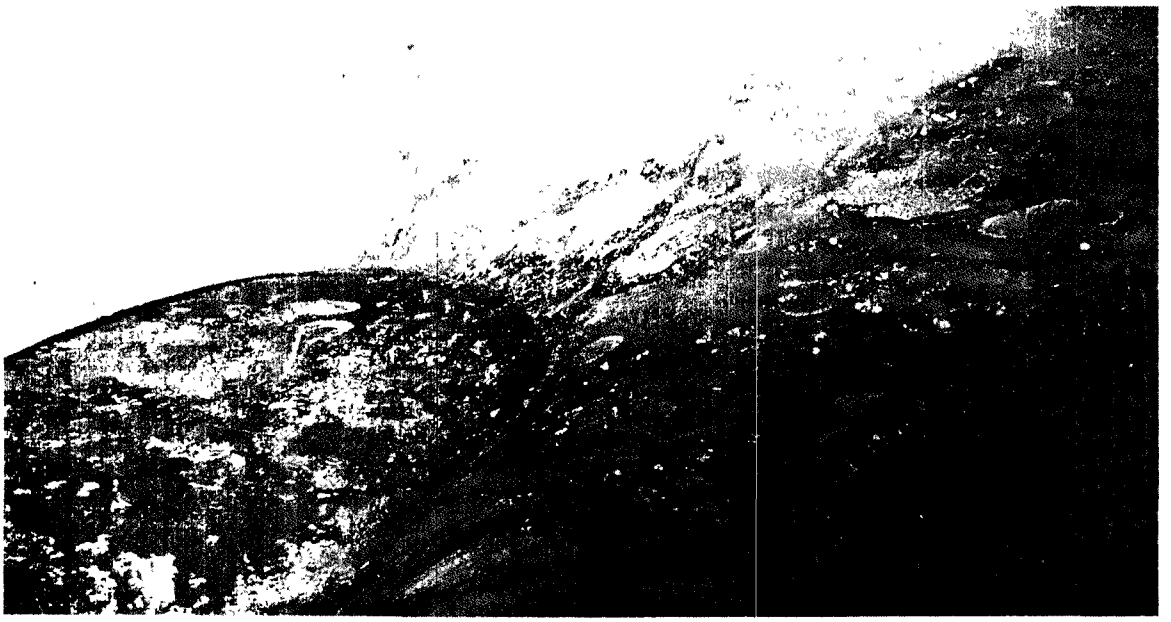


Picture 501 – Condenser B WB Outlet East Return Lower - SCR-8



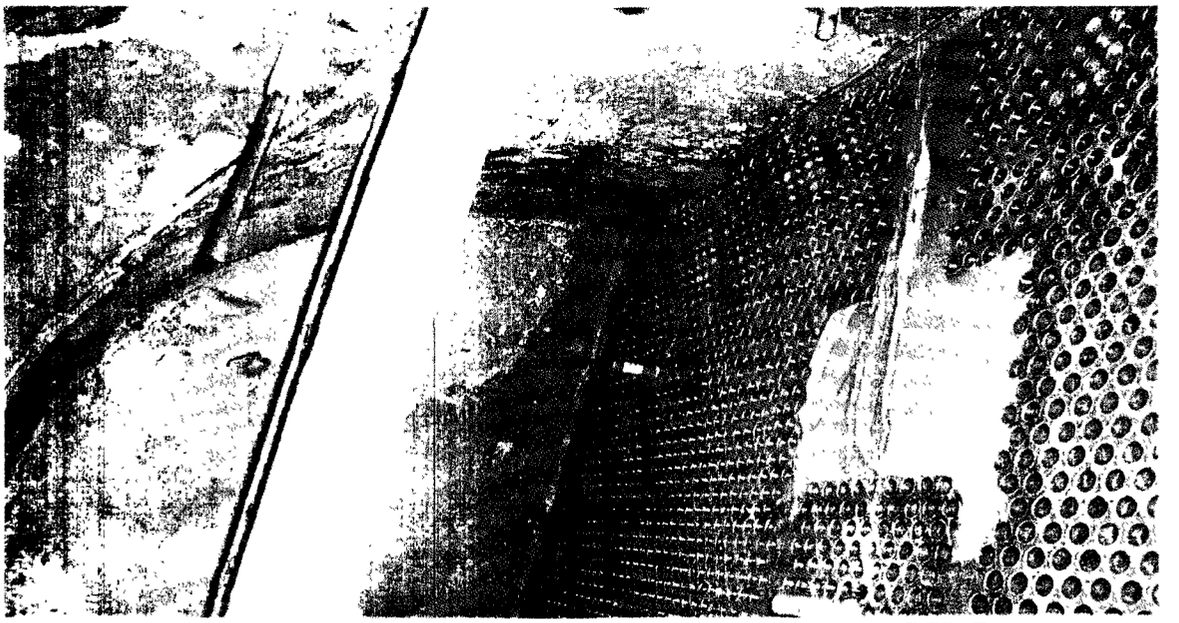
Picture 502 – Condenser B WB Outlet East Return Lower - SCR-8

Picture 505 – Condenser B WB Outlet East Return Lower - SCR-8



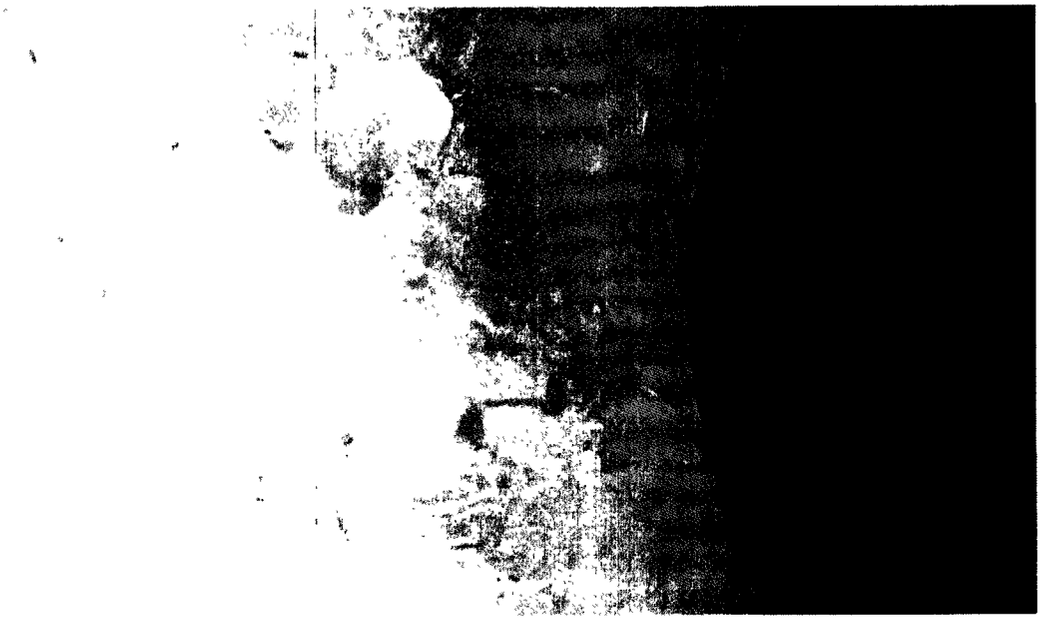
Picture 507 – Condenser B WB Outlet East Return Lower - SCR-8

Picture 519 – Condenser B WB Outlet East Return Upper- SCR-7

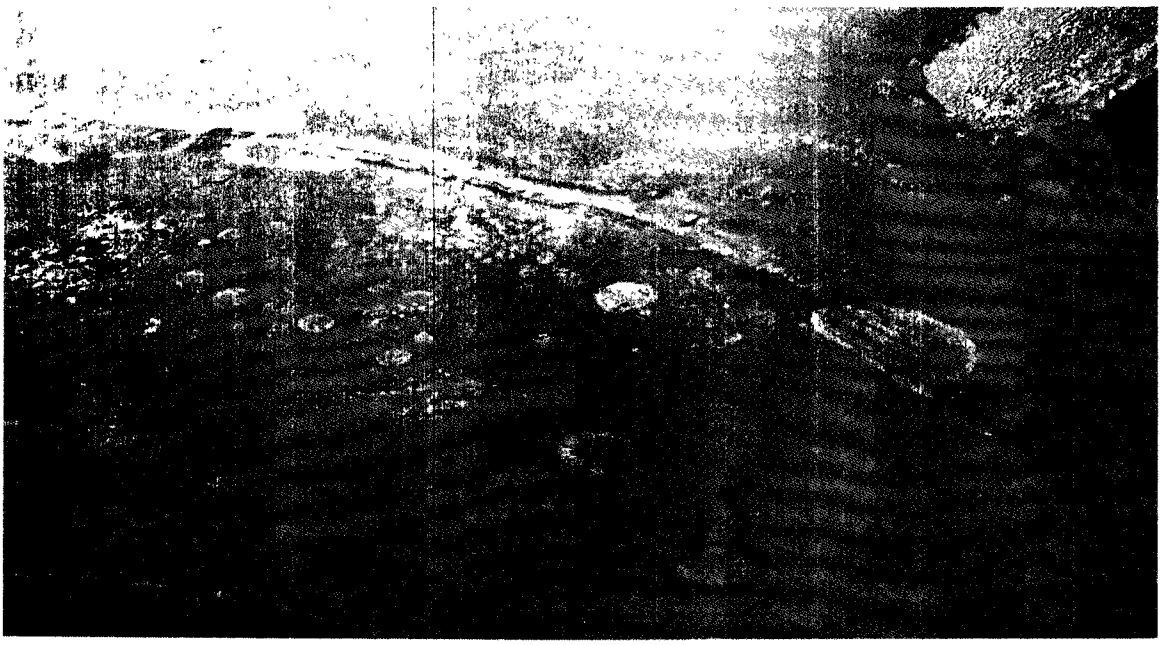


Picture 522 – Condenser B WB Outlet East Return Upper- SCR-7

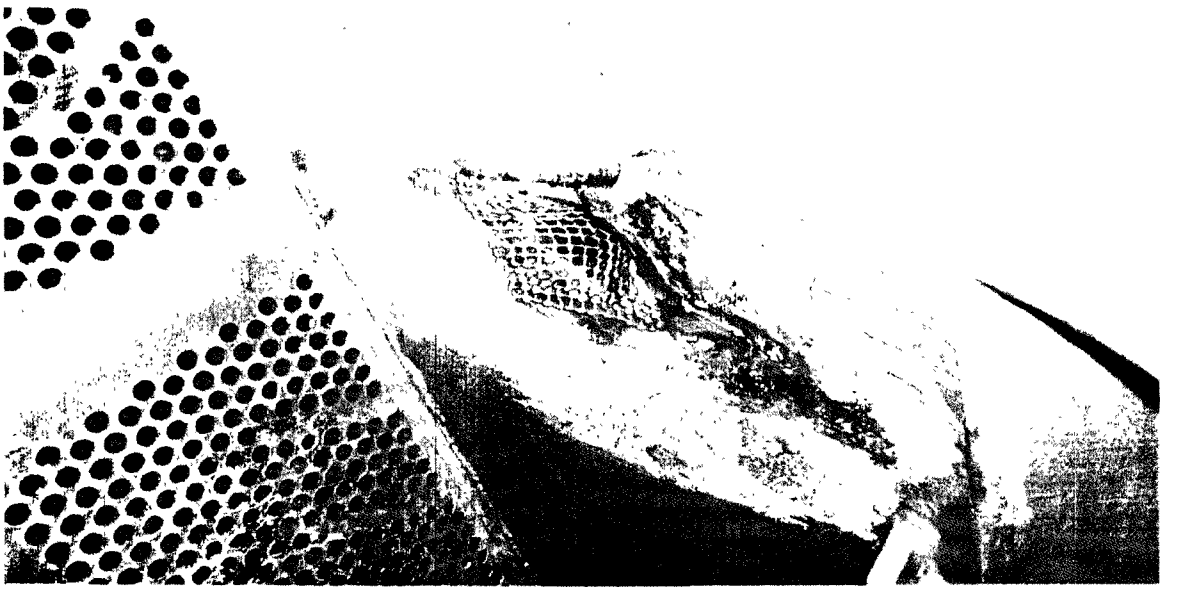
Picture 523 – Condenser B WB Outlet East Return Upper- SCR-7



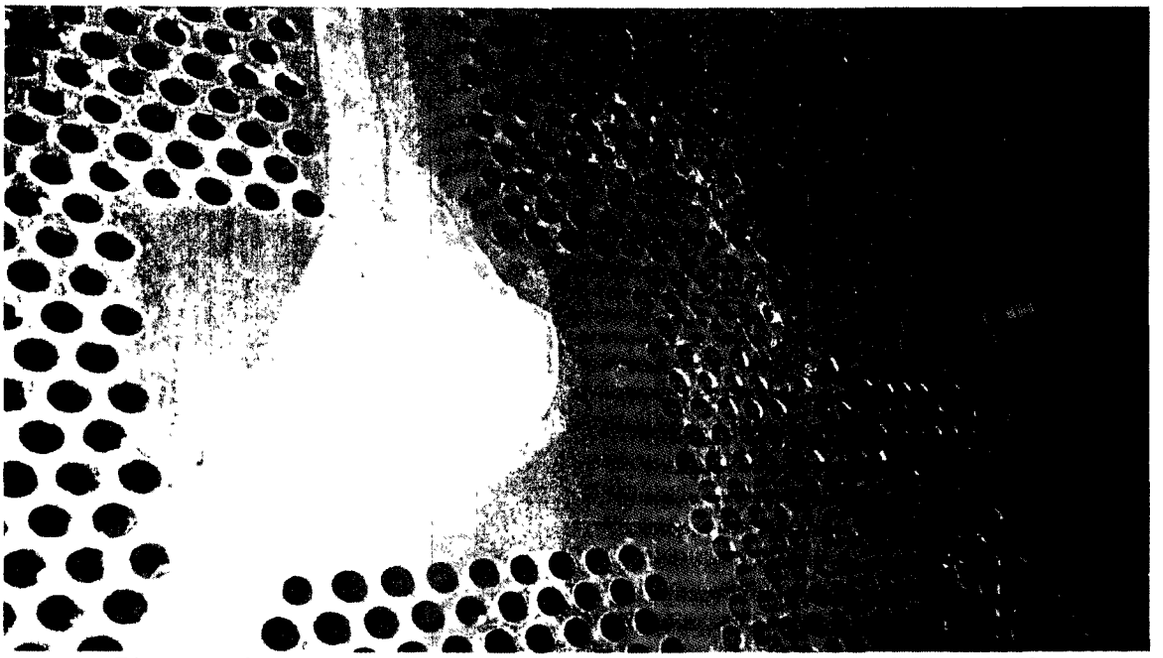
Picture 525 – Condenser B WB Outlet East Return Upper- SCR-7



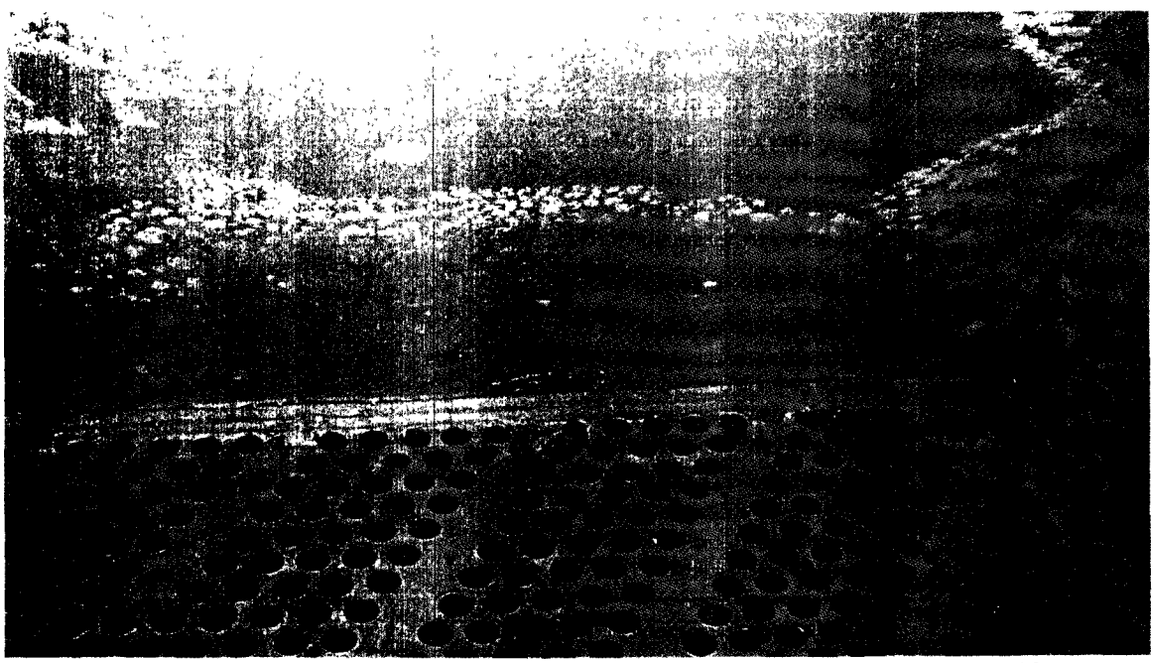
Picture 422 – Condenser B WB Outlet East Crossover Center - SCR-9 & 10



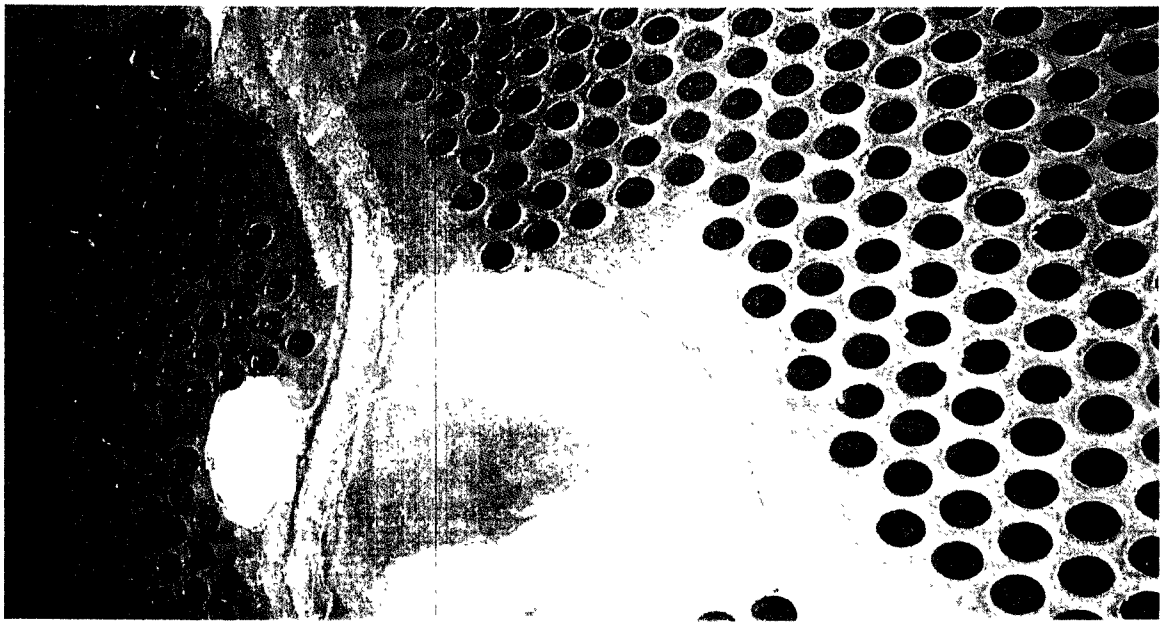
Picture 414 – Condenser B WB Outlet East Crossover Upper - SCR-9 & 10



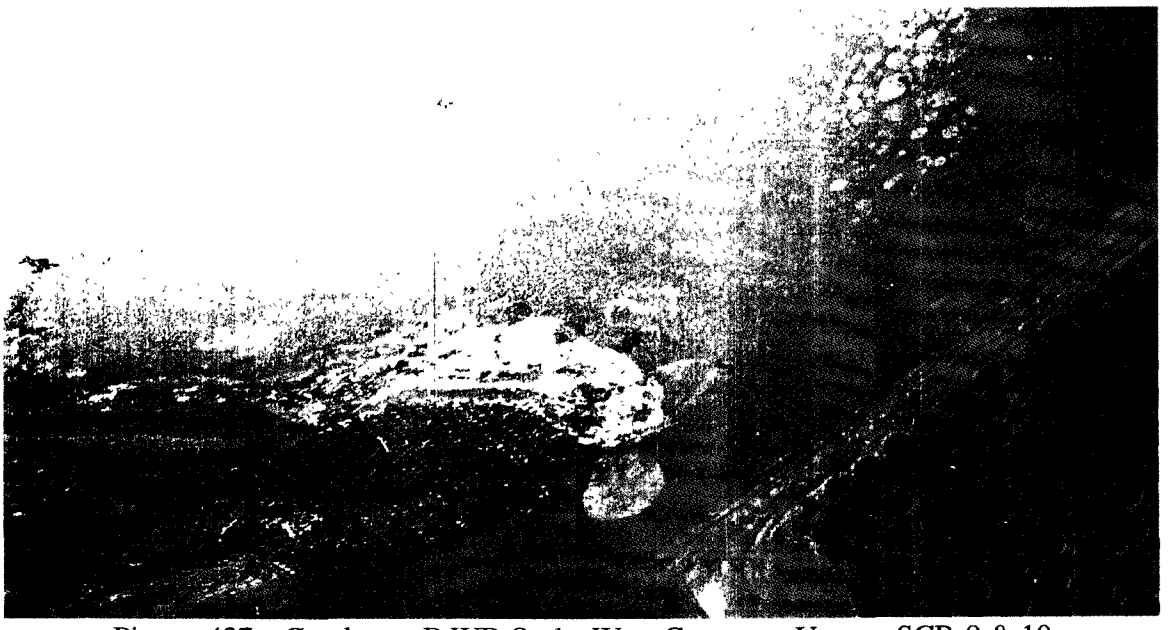
Picture 418 – Condenser B WB Outlet East Crossover Center - SCR-9 & 10



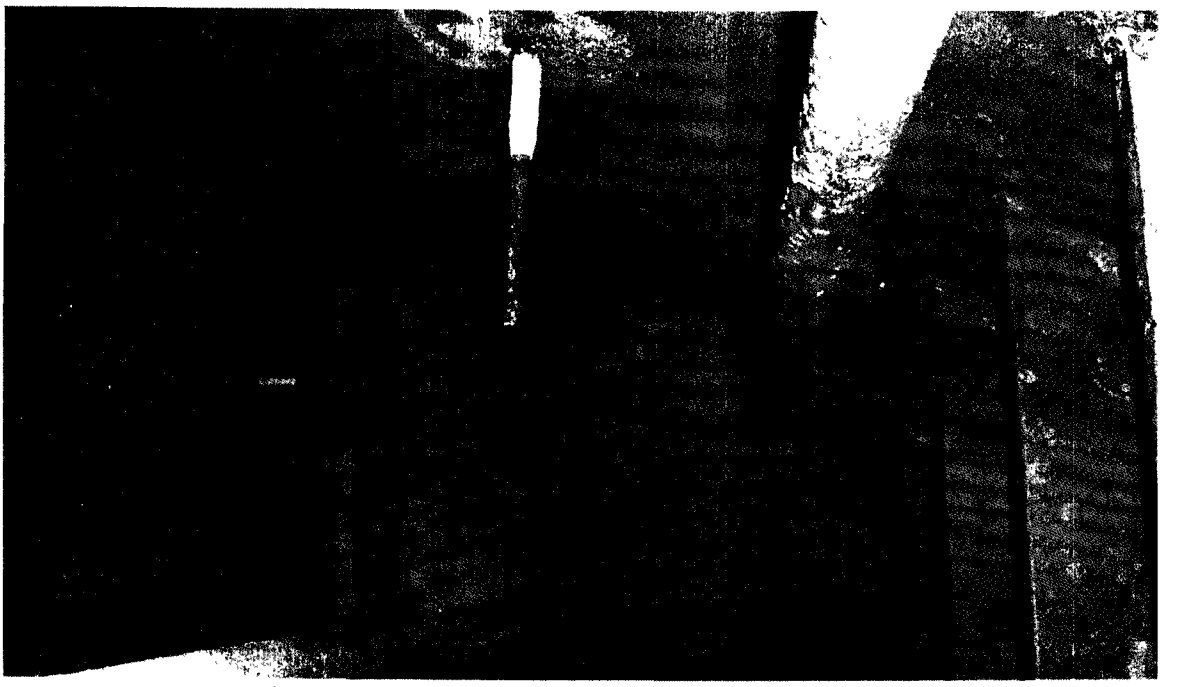
Picture 425 – Condenser B WB Outlet West Crossover Upper - SCR-9 & 10



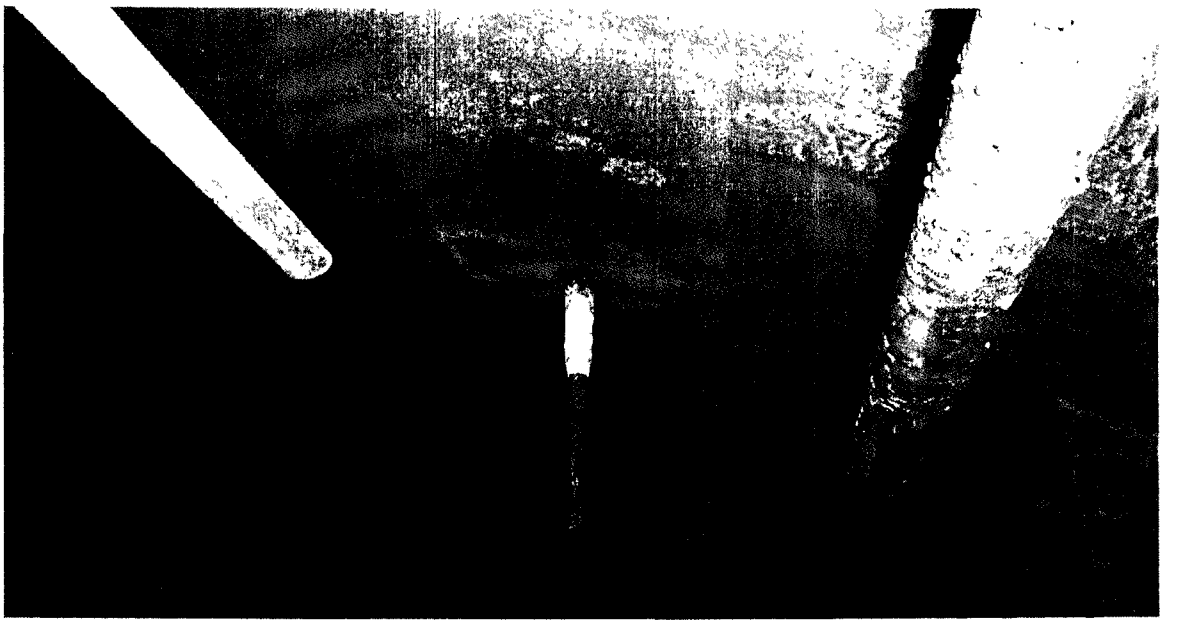
Picture 426 – Condenser B WB Outlet West Crossover Upper - SCR-9 & 10



Picture 427 – Condenser B WB Outlet West Crossover Upper - SCR-9 & 10



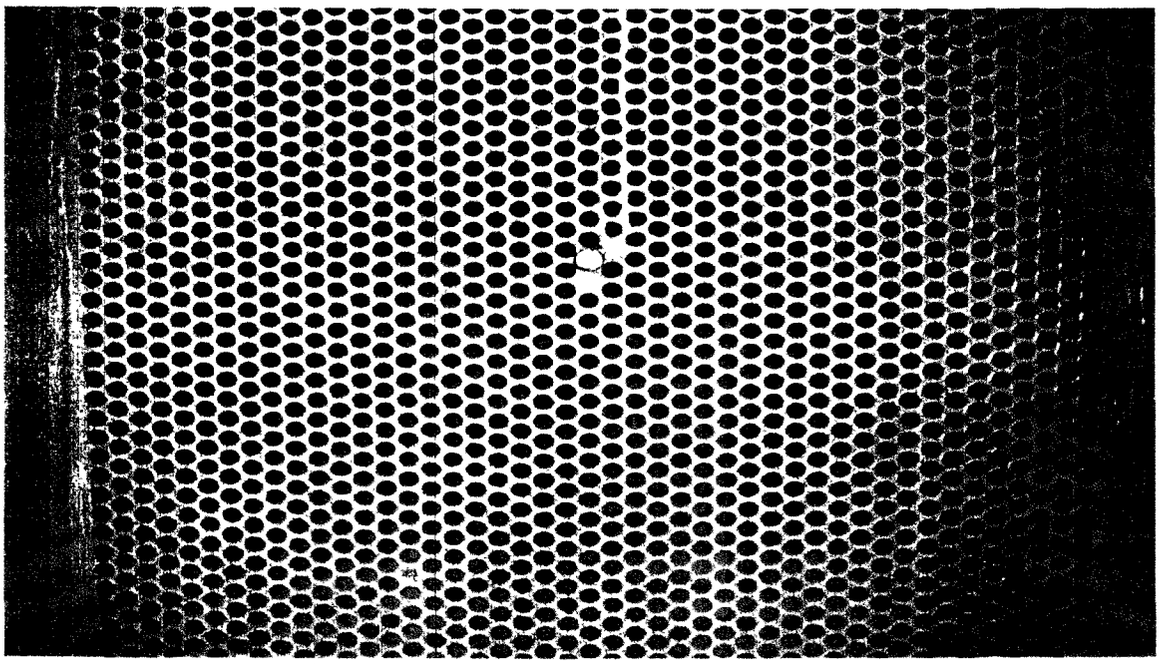
Picture 408 – Condenser B WB Outlet East - SCR-10



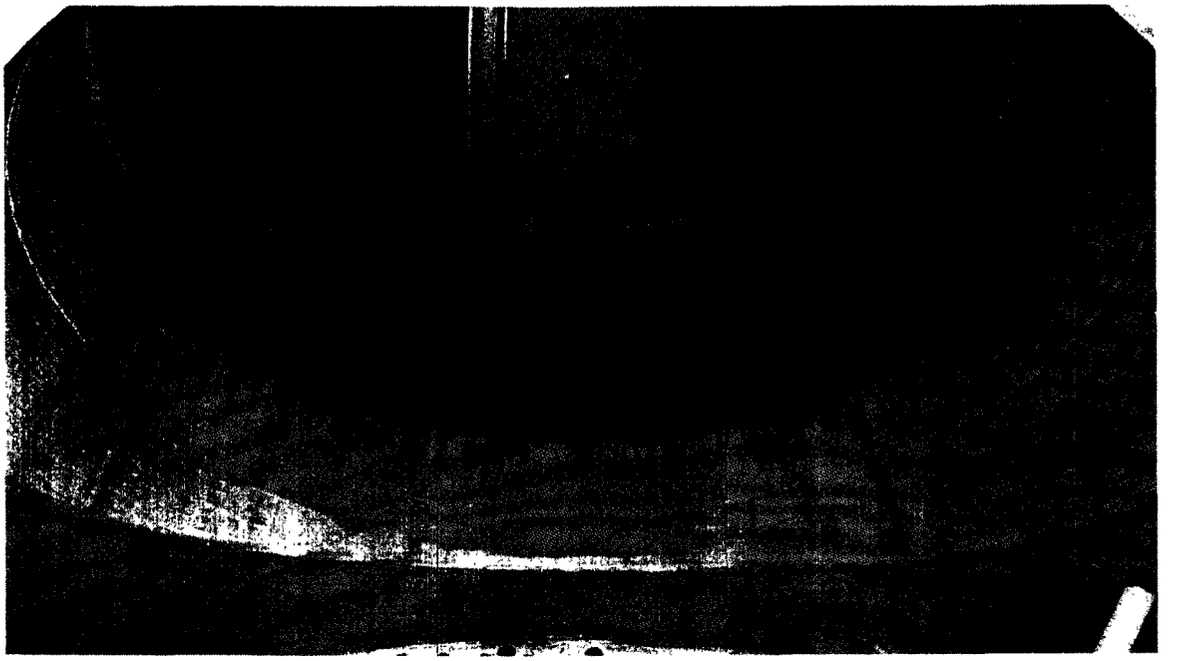
Picture 410 – Condenser B WB Outlet East - SCR-10

Picture 411 – Condenser B WB Outlet East - SCR-10

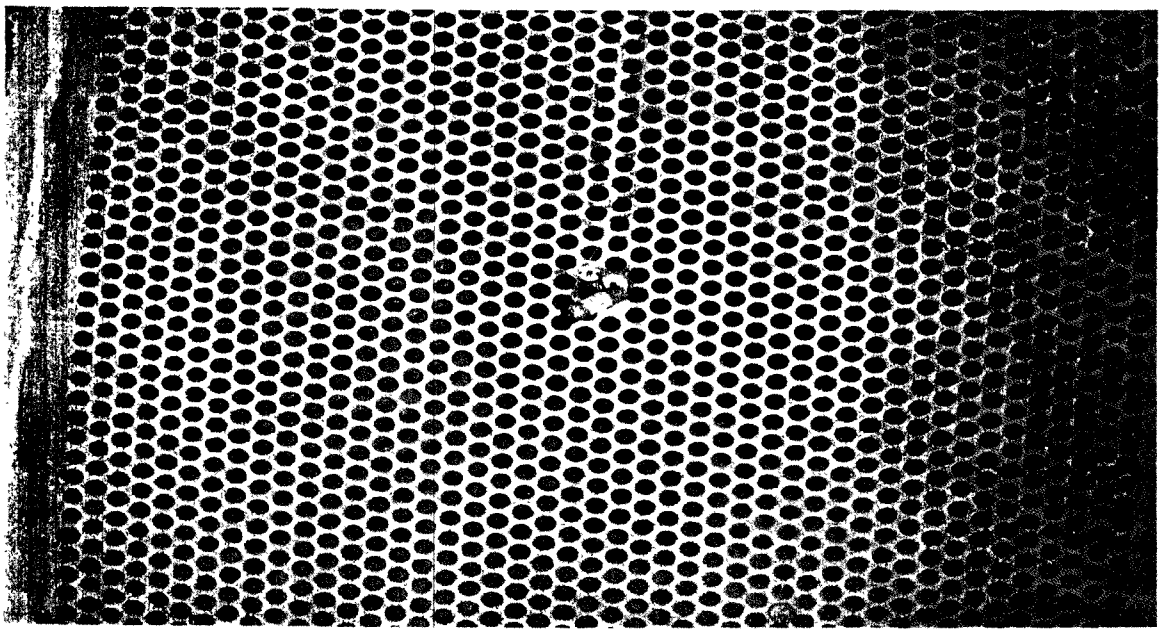
Picture 412 – Condenser B WB Outlet East - SCR-10



Picture 554 – Condenser B Aux Inlet - SCR-19

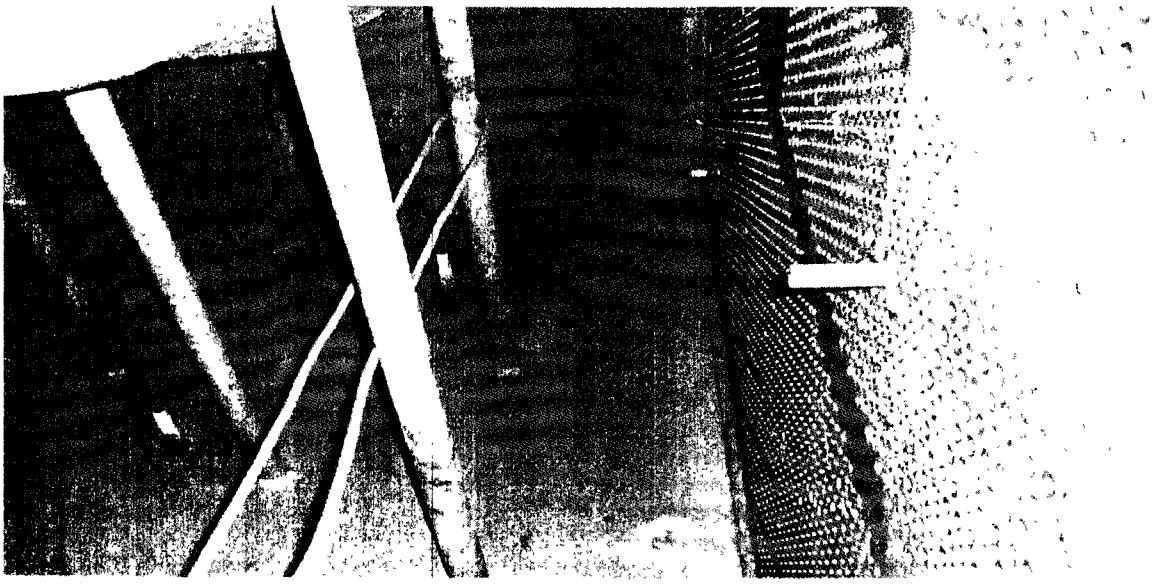


Picture 558 – Condenser B Aux Inlet - SCR-19

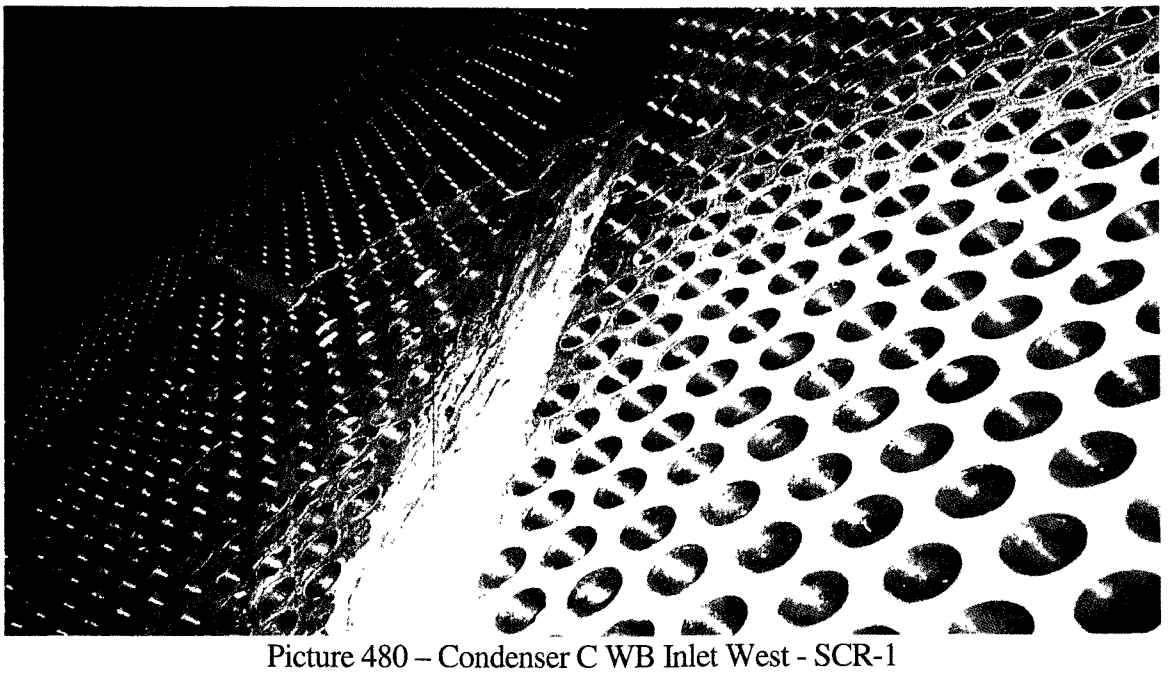


Picture 559 – Condenser B Aux Outlet - SCR-20

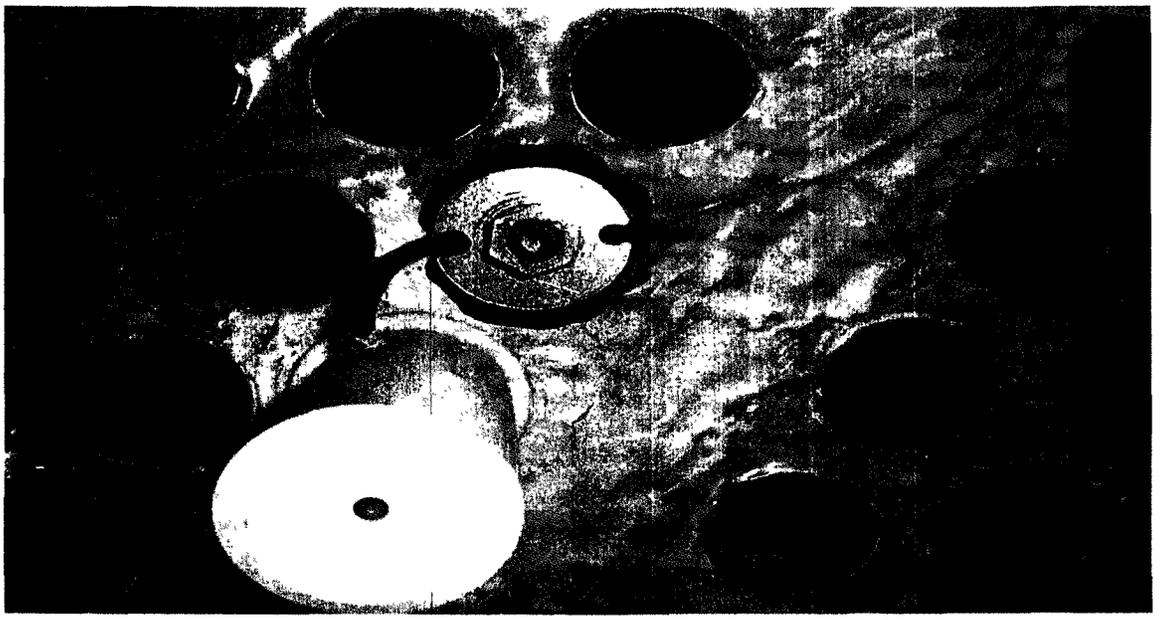
Picture 563 – Condenser B Aux Outlet - SCR-20



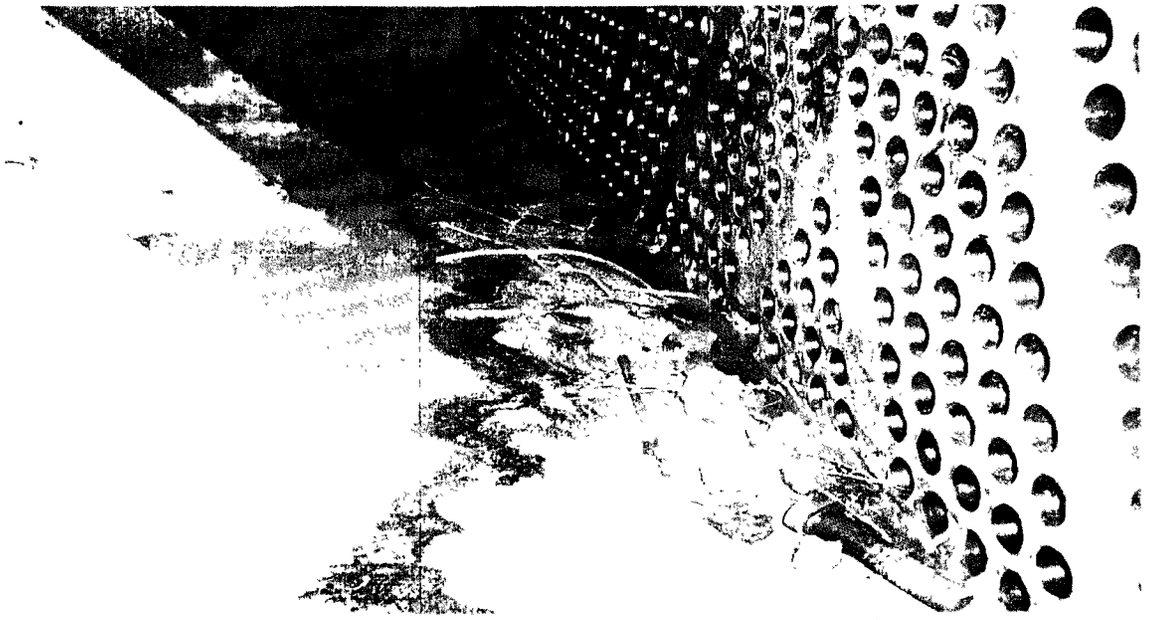
Picture 479 – Condenser C WB Inlet West - SCR-1



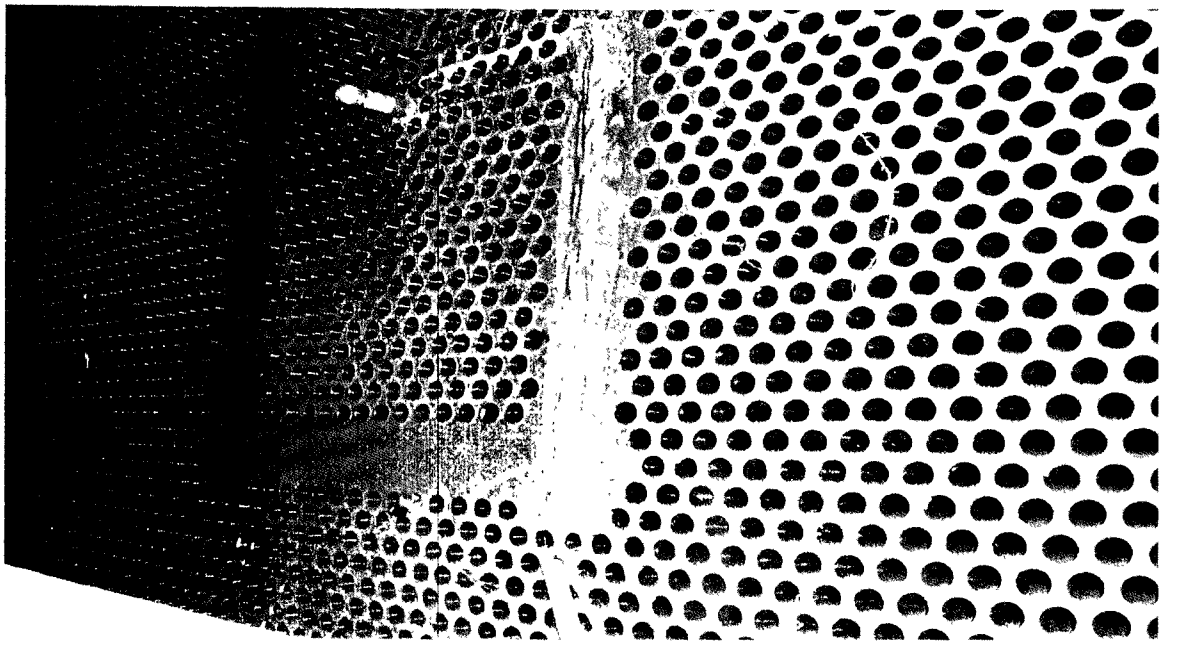
Picture 480 – Condenser C WB Inlet West - SCR-1



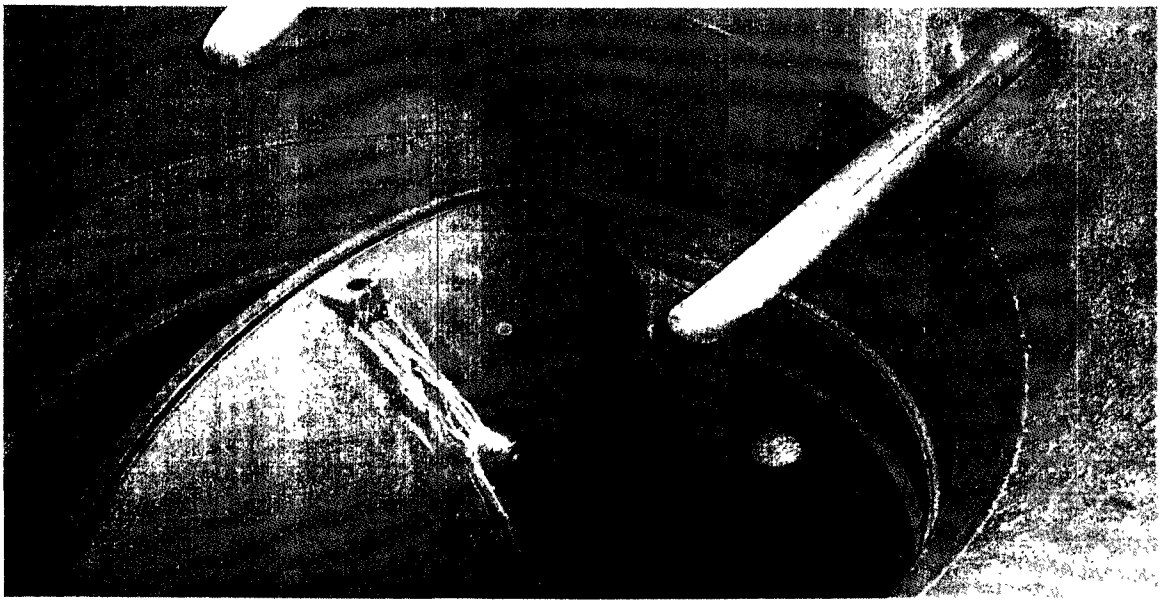
Picture 481 – Condenser C WB Inlet West - SCR-1



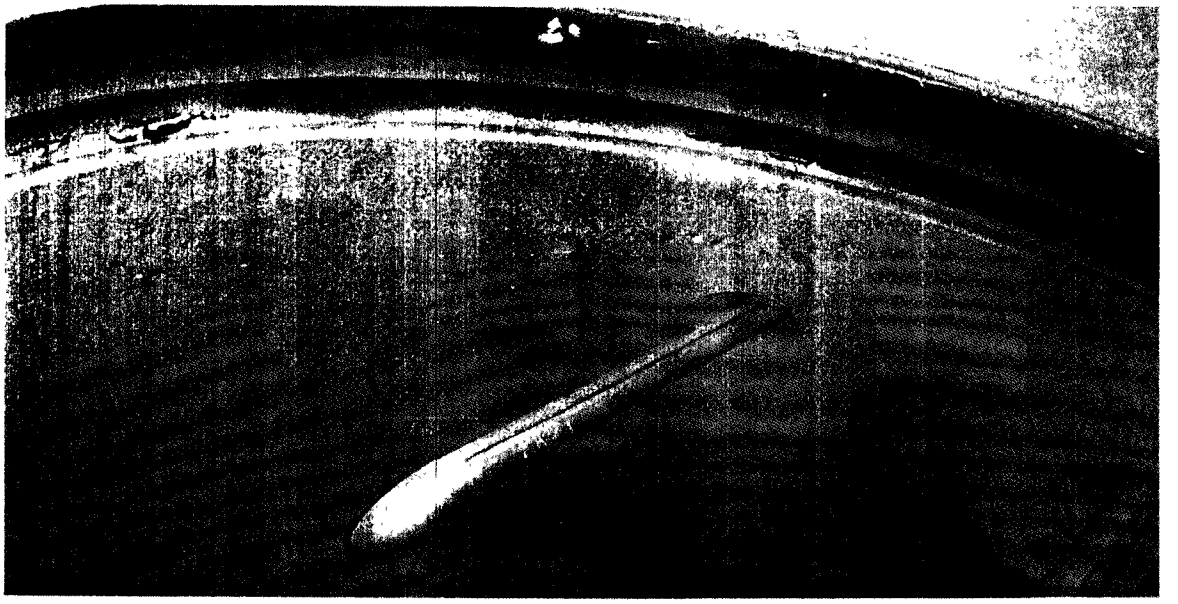
Picture 485 – Condenser C WB Inlet West - SCR-1



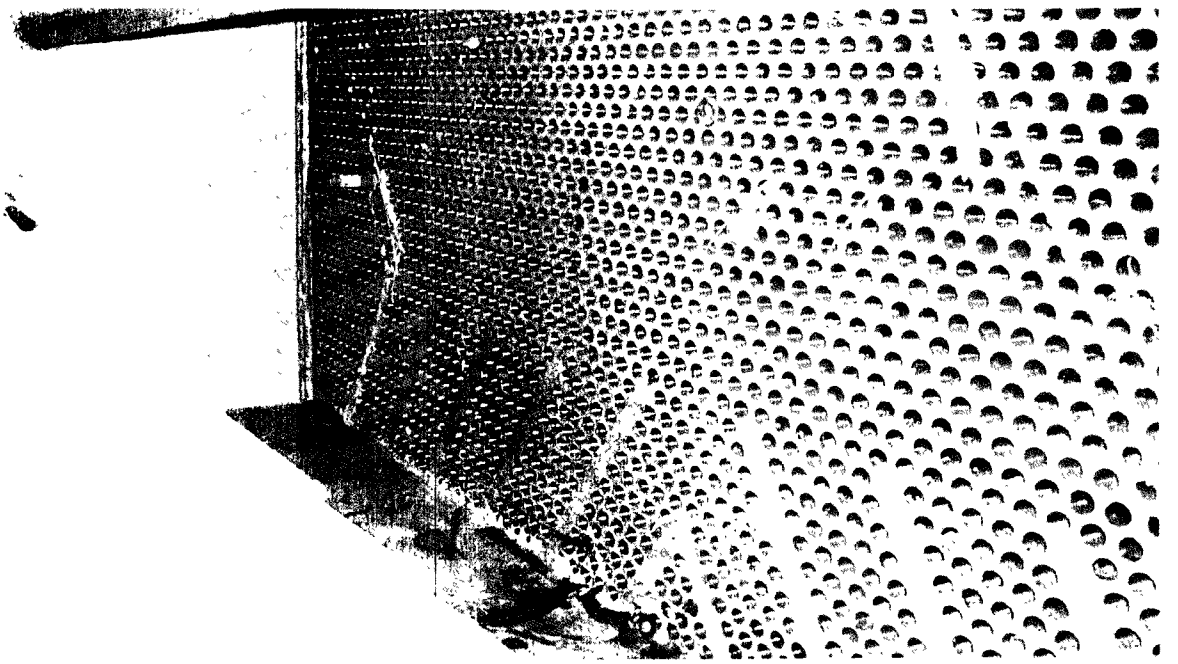
Picture 489 – Condenser C WB Inlet East - SCR-2



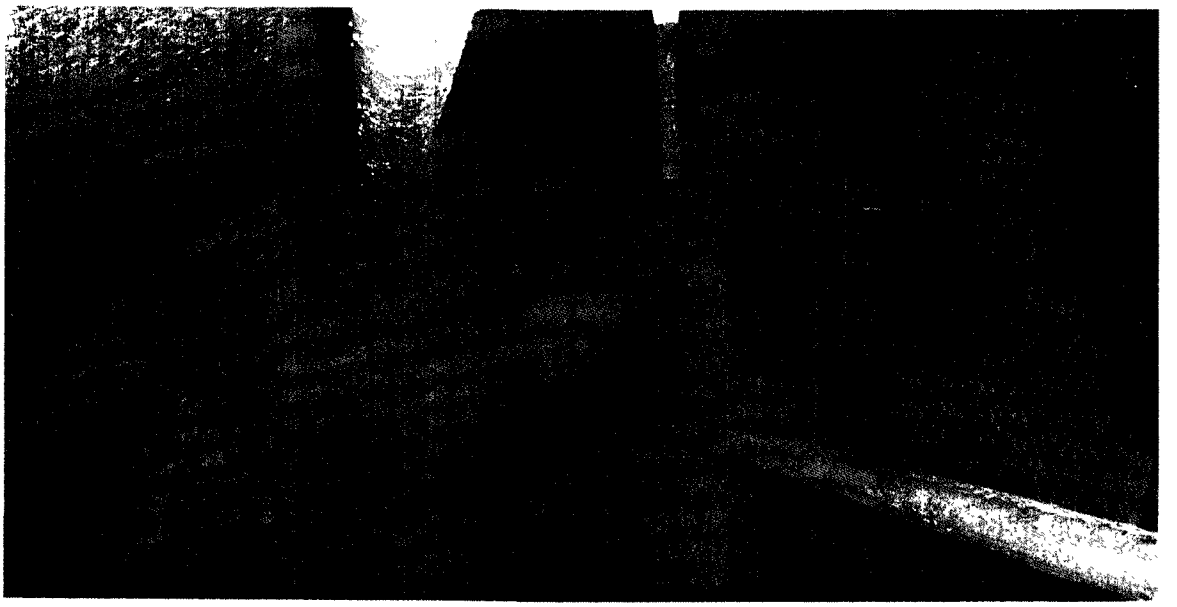
Picture 490 – Condenser C WB Inlet East - SCR-2



Picture 491 – Condenser C WB Inlet East - SCR-2

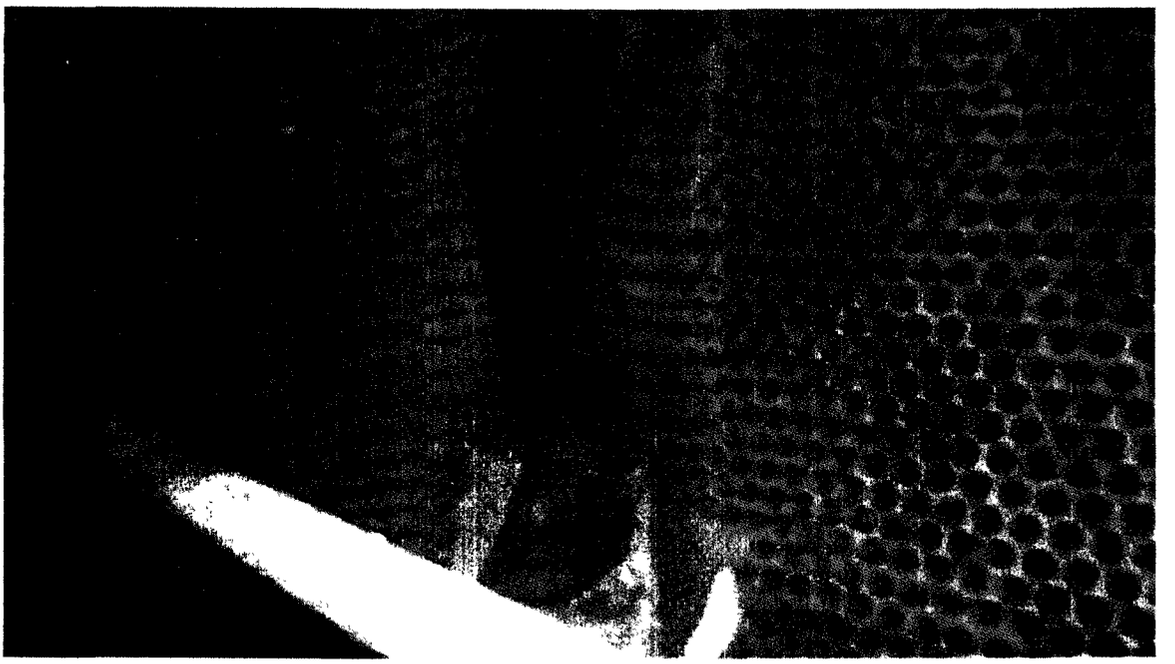


Picture 494 – Condenser C WB Inlet East - SCR-2

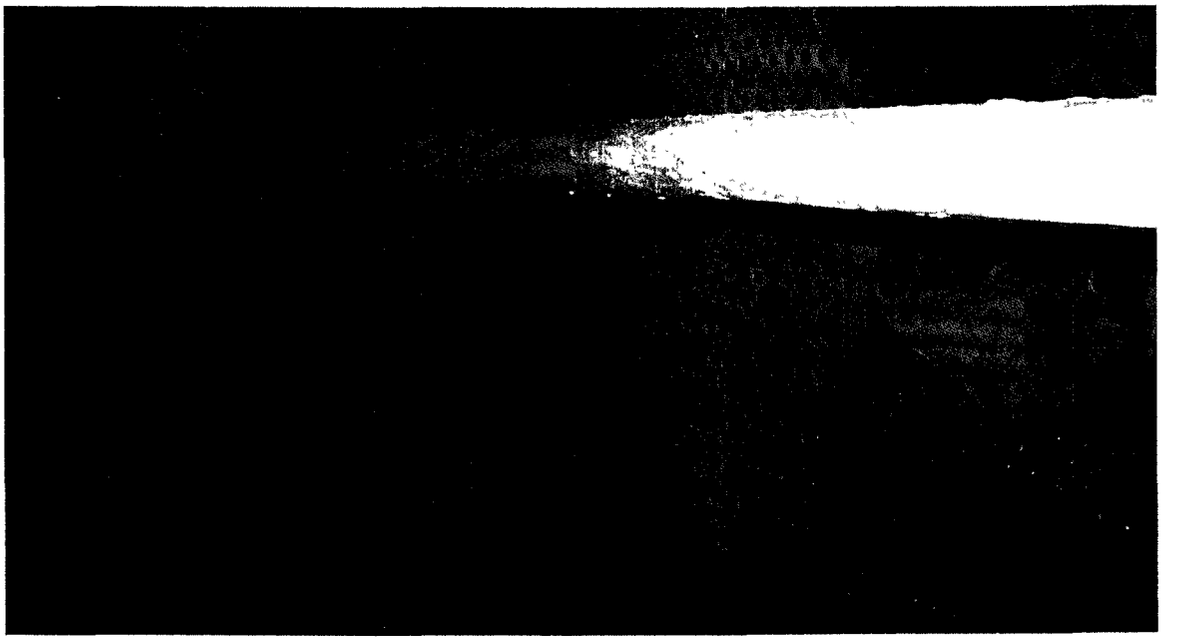


Picture 453 – Condenser C WB Outlet West - SCR-3

Picture 455 – Condenser C WB Outlet West - SCR-3



Picture 458 – Condenser C WB Outlet West - SCR-3



Picture 459 – Condenser C WB Outlet West - SCR-3

APPENDIX C

COST ESTIMATES

COST ESTIMATE
for
June, 2005

The following cost estimate has been prepared for tasks to be completed during the next Corrpro site visit plus design of cathodic protection for the circulating water pipelines and supplemental protection for the fire water piping in the switchyard.

Task	Estimate	Total - US Dollars
1.0 Condenser Water Box Detailed Testing		
Estimate 4 systems tested and adjusted per day - 20 in Unit 1 and 20 in Unit 2. Includes report .		
• Principal Engineer	12 hours @ $125/hr	1,200
• Project Manager	112 hours w/ travel @ $100/hr	11,200
• Technician	96 hours w/ travel @ $50/hr	4,800
• Air Fare	two @ cost plus 10%	1,600
• Per Diem	24 man-days @ $95/each	2,280
• Rental Car	12 days @ cost plus 10%	990
• Assistant	16 hours @ $40/each	640
2.0 Testing of Firewater Pipeline in Switchyard		
Inclusive of report and replacement system design		
• Principal Engineer • Project Manager	4 hours @ $125/hr 24 hours @ $100/hr	500 2,400
• Technician • CAD Operator • Assistant	16 hours @ $50/hr 8 hours @ $50/hr 4 hours @ $40/hr	800 400 160

3.0a Cathodic Protection Design For Circulating Water Lines inclusive of :		
Site Visit, Drawing Review, Design Calculations, Bill of Materials, Construction Drawings, Project Specification and Operation and Maintenance Instructions		
• Principal Engineer	16 hours @ $125/hr	2,000
• Project Manager	120 hours @ $100/hr	12,000
• Technician	90 hours @ $50/hr	4,500
• CAD Operator • Assistant	40 hours @ $50/hr	2,000
• Soil and Groundwater Samples	60 each @$100/ea	6,000
3.0b Subcontract Estimates		
• Soil Borings by RB&G (estimate 12 to 15) along circulating water lines. Three samples to be collected in each boring near top, spring line and bottom of pipe. Groundwater encountered will also be tested.	Lump sum @ cost plus 10%	11,215
• Pipeline Locating, Marking and Sub-meter GPS coordinates at an estimated 30 – 40 locations by MCM Engineering	Lump sum @ cost plus 10%	~10,000

Total $74,685

Actual charges will be in accordance with the Rate Schedule in Contract 05-45642.

Corrpro Companies Inc. would suggest that the next site visit be conducted ~~during~~ July, 2005. All work would be completed by September 30, 2005

MEMORANDUM

INTERMOUNTAIN POWER SERVICE CORPORATION

TO: Jon A. Finlinson

FROM: Jon P. Christensen

DATE: July 7, 2010

SUBJECT: DMAD Pipeline Transient Study

Technical Services has studied the hydraulic transient occurrences and their effect on the integrity of the DMAD surface water transmission pipeline. As a result of this study, we recommend that the pressure transient events be mitigated by modifying the operation of motor operated by-pass valve 9WSA-MBV-005. Leaving this valve open for a short time after a trip will provide a path for dissipation of the pressure transients. We also recommend that pressure and flow data from the pump station be integrated into the PI system.

The intent of this memo is to summarize the results of the study and further explain the reasons for this recommended action.

History

The surface pipeline was breached in September 2008, after the DMAD pumps shut down due to a power outage. A subsequent pipeline examination identified several sections of the DMAD pipeline that have been weakened due to corrosion. The pre-stressing wires provide the majority of the pipelines structural strength. This study has been undertaken in order to determine a method in which to mitigate the hydraulic transient that caused the line to break.

Hydraulic Transients

Any change to the flow characteristics of a hydraulic system will generate a hydraulic transient or water hammer. As systems get larger and as flow changes become more abrupt, more force will be generated by the transient event.

Due to the large quantity of water being moved by the surface water supply system, it is reasonable to expect transient events when system flow changes. This has become a critical issue due to the weakened state of some DMAD pipeline sections.

Pressure probes and a data logger were installed at the DMAD pump station shortly after the 2008 line break. The data has been gathered after significant changes to system flow in order to gain an understanding of the cause and severity of transient events. Figure 1 below shows a transient event recorded in April 2009.

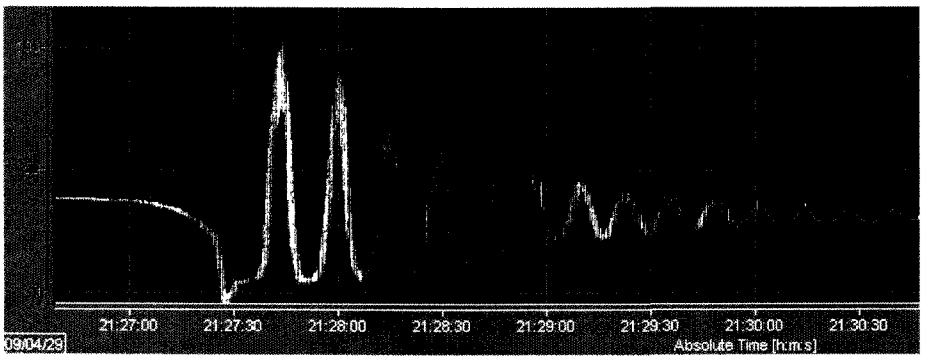


Figure 1

The red line in the figure represents pressure measured downstream of the check valve. This is the most severe transient event that has been recorded to date. It was the result of a power outage at the pump station when two pumps were in operation. Pressures reached a maximum of 102 psig and a minimum of -5 psig.

System Modeling

A computer model of the DMAD pumping and transmission system has been constructed using Bentley HAMMER hydraulic transient modeling software. Field measurements, construction drawings, compiled transient data and equipment specifications were utilized to make the model match the existing system as closely as possible.

The model has been calibrated to mimic the transient event shown in Figure 1. Figure 2, below, shows the results of a two-pump power failure simulated by the modeling software. The results are reasonably similar and provide a good representation of the system. This model facilitates testing to determine the probable worst case as well as transient protection alternatives.

It is interesting to note the modeled pressure at the location of the 2009 pipe failure (approximately 500 feet from the pump station) of approximately 85-90 psi. This is above the hydrostatic test pressure of just 75 psi.

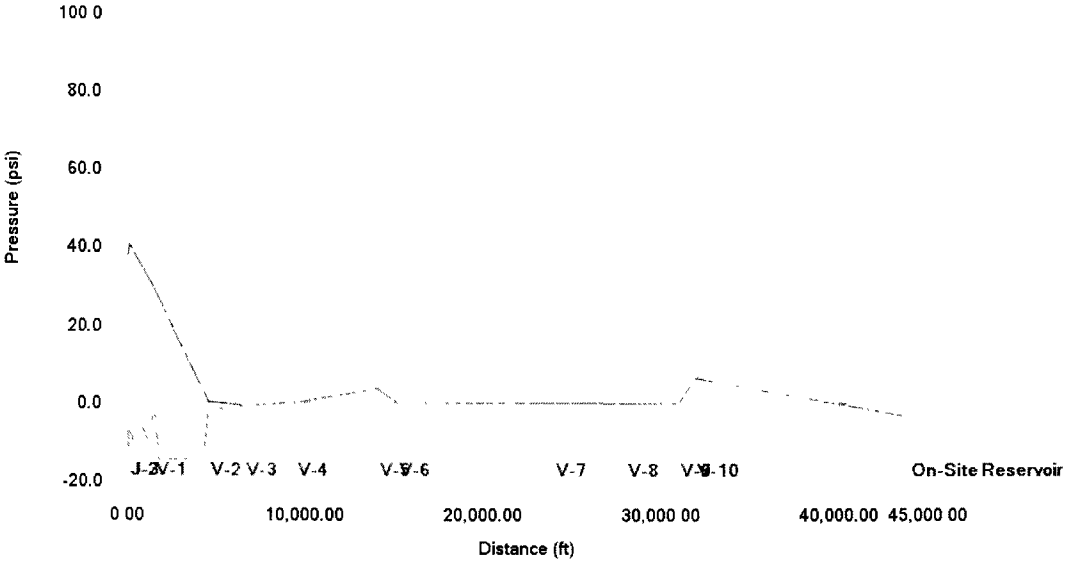


Figure 2

Worst Case Scenario

It has been determined that the most extreme pressures will be experienced when two pumps shut down during a power outage at the pump station. This seems counter intuitive at first, but the surge is being initiated on reverse flow not forward flow. The model has shown that the water column separates at Air Vent 3 which is the highest point in the system. In the three pump scenario, the greater forward flow and increased momentum causes the check valve to close more slowly than in the two pump scenario resulting in a decreased pressure transient. For this reason, the two pump shut down scenario was used to test alternative methods for reducing the extreme pressures caused by transients in this system.

The pressure envelope for the two pump shut down scenario is shown above in Figure 2. The maximum pressure that will be seen by the pre-stressed concrete line is approximately 96 psi. It is interesting to note that since the water column separates at Air Vent 3, a much less severe pressure wave propagates from Air Vent 3 to the Onsite Reservoir. This should protect the pipeline beyond Air Vent 3 from any damage due to extreme pressures.

Transient Protection Alternatives

There are generally three ways to reduce the severity of a hydraulic transient:

- Change the wave speed by introducing air into the system.
- Increase the time over which flow velocity is reduced by lengthening the check valve closing time or leave the bypass valve open for a short time.
- Vent excess surge pressure through an automatic valve

Of these three, only two are cost effective, the addition of air vents to the pipeline would be prohibitively expensive since it would require replacement of pipe sections. We will look at the other two alternatives in greater detail.

.

Alternative A

Alternative A involves increasing the time over which the system flow is reduced to zero to no less than 45 seconds by leaving the bypass valve open. The pressure envelope for this alternative is shown in Figure 3. With this system in place, the maximum pressure seen by the pre-stressed concrete pipe is reduced to 63 psi.

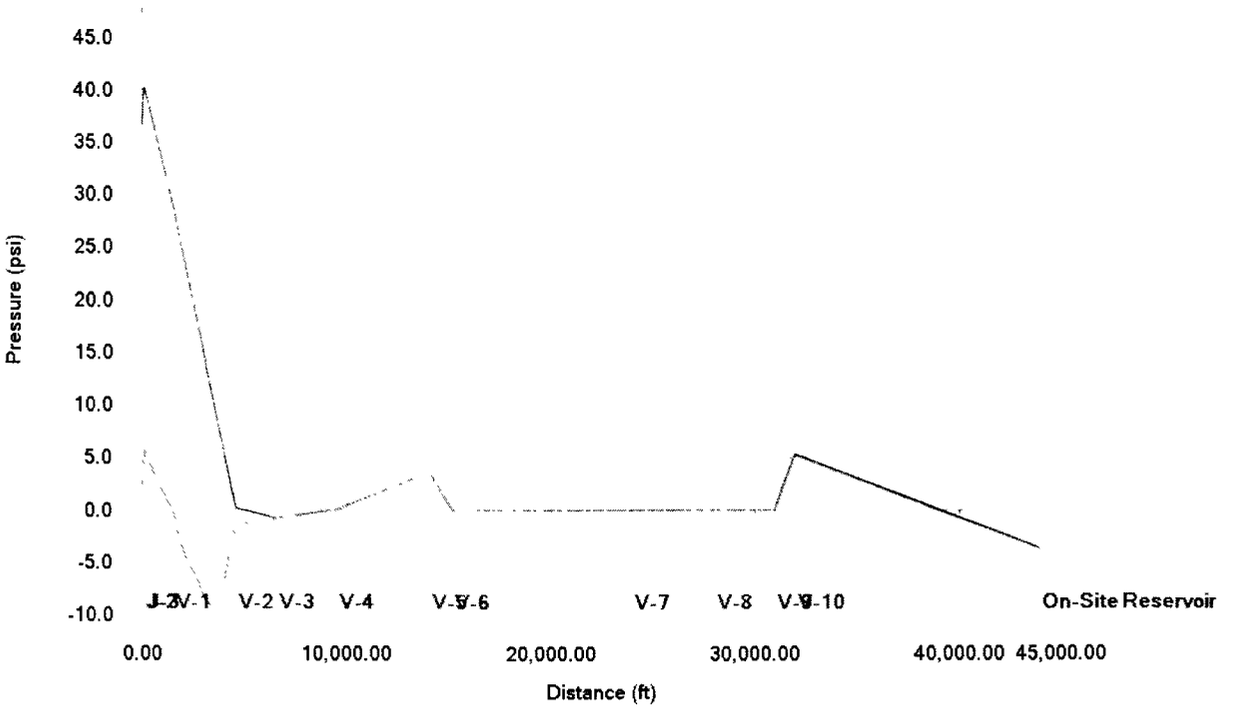


Figure 3

This brings up the question of reverse flow through the pumps. The attached equipment specification shows that the DMAD pumps are designed to handle reverse flow with no damage to the pump nor the motor.

Alternative B

Alternative B would require installation of an automatic surge anticipating pressure relief valve in the 48" steel header pipe in the pump station building. This type of valve is designed to open on the low pressure sensed when pumps shut down. The valve would then not close for a set period of time and vent excess pressure to atmosphere.

Piping could be routed to vent excess pressure back into the reservoir. Figure 4 shows the pressure envelope resulting from this alternative.

The valve settings for the output shown were an 18" steel line feeding a 16" surge anticipator valve set to open over 15 seconds, remain open for 10 seconds, and close over 30 seconds. The maximum pressure seen by the pre-stressed pipe is approximately 45 psi.

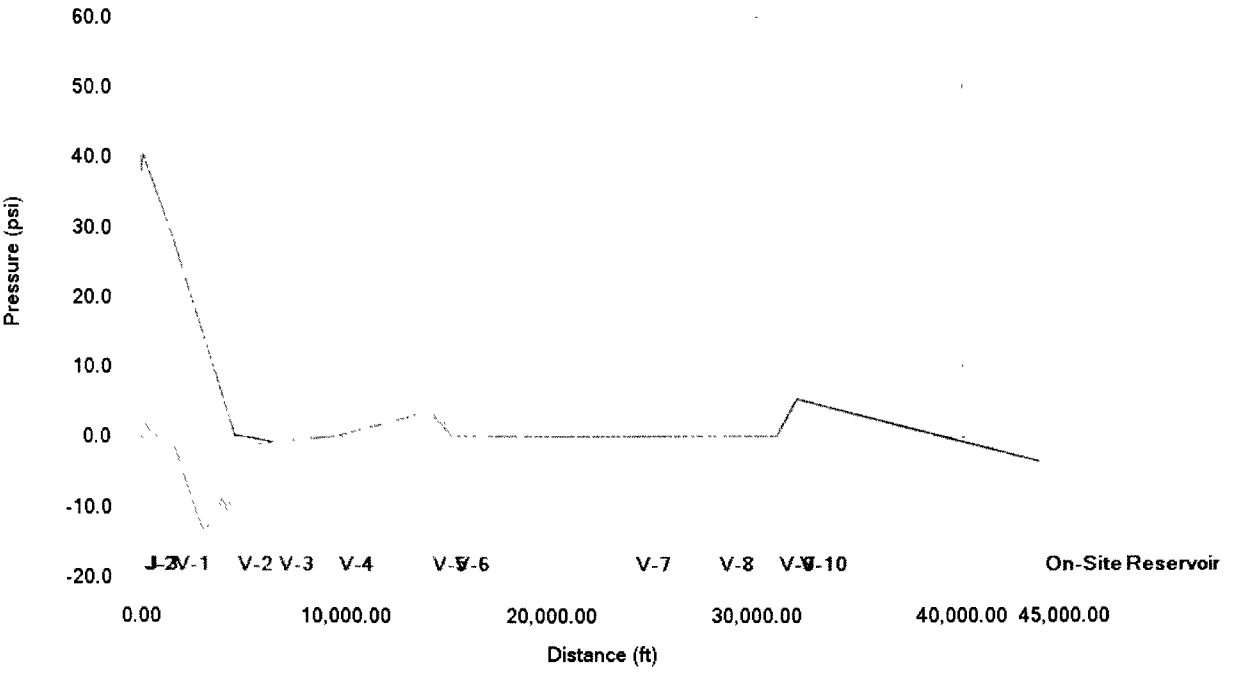


Figure 4

Recommendations

Both alternatives discussed do essentially the same thing. The only difference is which route water takes back into the reservoir. Since we believe that reverse flow through the pumps will have no detrimental effect, it is recommended that the bypass valve controls be modified to keep this valve open for 45 seconds after each shutdown. Pump restart would also have to be blocked until the valves closed and reverse rotation ceased to occur.

It is further recommended that the pressure and flow data from the DMAD Pump Station be brought into the PI system in order to more readily monitor the effect of system changes and the effectiveness of pressure transient mitigation efforts. Engineering intends to pursue the control change to the bypass valve as soon as possible. A separate memo will be sent with the details of the change for your approval at a later date. We will place a project on the 2011-12 budget for wiring the DMAD Pump Station information into the PI system.

If you have any further questions concerning this matter, please contact Mike Steele at extension 6423.

MJS/JKH:jmj

Attachment: